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THE UNIVERSITY OF ALBERTA

THE MEDIUM: AN INQUIRY INTO THE NATURE OF THE AUTHORING PROCESS IN A COMPUTING MEDIUM

by

STEPHEN JOHN KEMP

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A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH

IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE

OF DOCTOR OF PHILOSOPHY

DEPARTMENT OF ELEMENTARY EDUCATION

EDMONTON, ALBERTA

FALL, 1993

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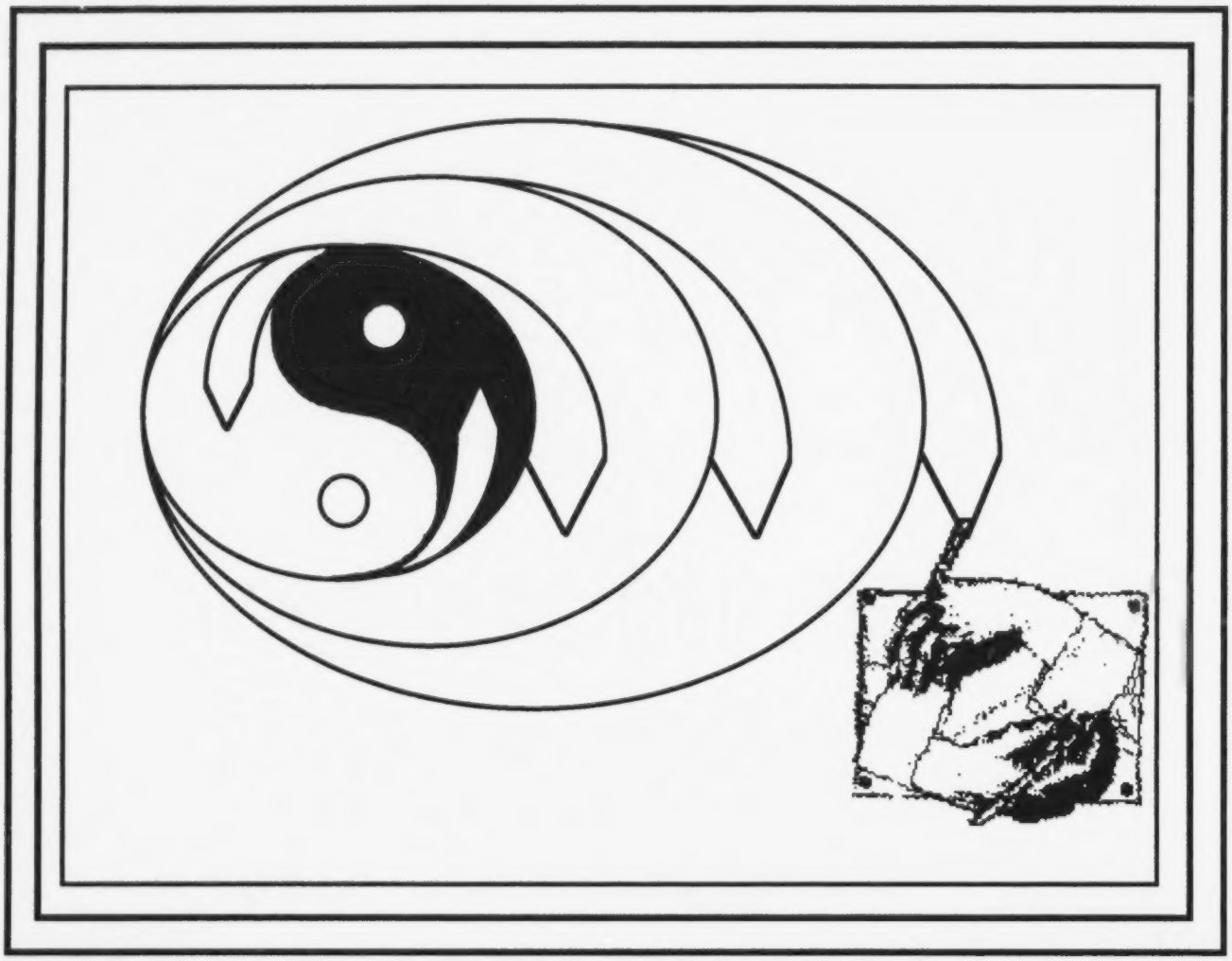

In this issue: *An inquiry into the nature of the authoring experience in a computing medium*

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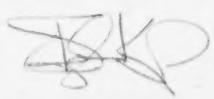
(Signed) 

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The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research for acceptance, a thesis entitled THE MEDIUM: AN INQUIRY INTO THE NATURE OF THE AUTHORING PROCESS IN A COMPUTING MEDIUM submitted by STEPHEN JOHN KEMP in partial fulfilment of the requirements for the degree of DOCTOR OF PHILOSOPHY, COMPUTER APPLICATIONS IN ELEMENTARY EDUCATION.

Dr. Daiyo Sawada (Supervisor)

Dr. Milton Petruk

Dr. Roberta McKay

Dr. John Oster

Dr. Jerome Harste (External Examiner)

DATE: March 30, 1993

To Daiyo, my mentor and friend, for his quietness, his listening, his wisdom, his friendship, for my blindspots, for helping me keep the autopoiesis going

To my dad, Stanley Frank Kemp, for his courage, his vision, and his love, and for his unfailing devotion and support of his family

To my mum, Marion Eileen Kemp, for her love and friendship, her support, all given in unselfish abundance, and for helping me get back on my feet again

To Micheala, my love, my sunshine, my medium

To Erin, my daughter, for her smiles, her love, and her faith in me

To Robbie, my son, my friend, for all that has been, and all that will be

To Dr. Roberta McKay, for her vision and her insight, for possible worlds, for writing with Voice, for her warmth and charm

To Dr. Milt Petruk, for his perceptiveness, his energy, his wonderment and his guidance

The medium

An inquiry into the nature of the authoring experience in a computing medium

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Abstract

As is the nature of all environments, the medium that is education, and in particular educational computing, is in a constant process of change and evolution. One aspect of this dynamic, open process is the emergence of computer-based, multimedia authoring environments such as HyperCard from Apple Computer Inc., which promises to re-define our notions of what it means to "author". Authors can now incorporate not only text and graphics into their compositions, but also sound, digitized graphics, and animation, and do so using mouse technology and graphic interfaces. The issue which emerges is the nature of the authoring process: What does it mean to author in the medium of computer-based, multimedia authoring environments?

Jerome Harste et al have described the authoring cycle (1984), the situational context or ground from which the figure that is computer-based, multimedia authoring is emerging. Described as a recursive complementarity (Sawada,1986), this re-vision of the authoring process can be seen as the nature of the relationship between two, seemingly mutually exclusive aspects of the whole, but both of which are necessary for a full and complete description. It is to the description of the figure, that this research is dedicated, an inquiry into the nature of the authoring experience in a computing medium.

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Welcome to Macintosh
Volume 2, Number 1

Welcome to Macintosh! Welcome to our issue on one specific medium, the Macintosh computing medium: a place, a machine, a Way of Knowing, a Way of Doing, perhaps even a Way of Being.

Welcome to Macintosh: Reflections on the emergence of community

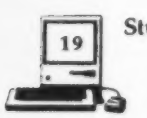
A community is slowly emerging at Bishop Pocock School, a community of learners engaged in a continual process of growth and change.

Welcome to Macintosh: Reflections on the nature of a computing medium

A dynamic medium has, at all points in its evolution, two aspects, each of which must work in a complementary fashion to maintain the poiesis, or creative activity of the unities which exist as part of the medium. This paper describes those internal and external aspects, and relates them to the Macintosh computing environment.

The computer-based, multimedia authoring process using PowerPoint: medium/messages/meaning

The medium is the situational context in which all instances of authoring are embedded (Harste, 1984). This paper describes the nature of those instances of authoring in terms of the context that is PowerPoint, a computer-based, multimedia authoring application.



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A re-vision of the role of technology in the educational process necessitates that we also re-examine our concepts of the roles of, and relationships between, the 2 key elements in that process: the teacher and the learner.

Language, Culture and Community

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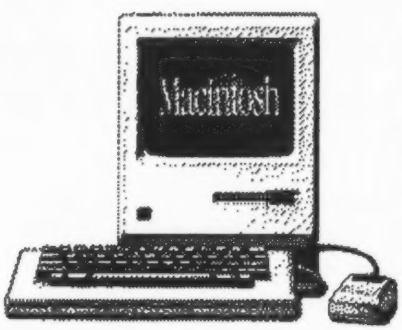

Understanding hypermedia
Volume 2, Number 2

As I approached the lab it was obvious that the normal chit-chat and giggling and visiting that described the working atmosphere of the lab had given way to something far more boisterous. They were discussing what noises a camel made!

Welcome to "The Lab": Bringing a camel to life!

Reflections on the nature of what one student described as "a very, very special place to be".

Understanding hypermedia

Hypermedia, or interactive multimedia, is serving to re-define our notions about the role of computing technology in education. This article will describe hypermedia, it's elements and attributes, and discuss the implications for education.

Converting linear print to hypertext: A narrative

Hypertext must be experienced to be understood. This article will describe the authoring process, issues and challenges of converting a linear text to a hypertext.

Teacher as learner as researcher: A dialogue

At any point in the research process, Stephen Kemp was at one and the same time a teacher, a learner, and a researcher. In conversation with *The medium* , Mr. Kemp discusses this approach to naturalistic inquiry.

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Concept mapping and HyperCard: The construction and articulation of meaning

This article will describe the concept mapping approach, illustrate the applicability of concept mapping to the introduction, design and development of hypermedia for elementary school students, and conclude with a description of a computer-based, interactive, multimedia research project.

Concept maps: A recursive revision

Elaborating on the concept mapping approach for the construction and negotiation of meaning, this article features iconic representations and group discussions of the meaning of HyperCard for Grade 8 students at Bishop Pocock Elementary School.

The ecology of hypermedia
Volume 2, Number 3

The ecology of hypermedia, therefore, is iconic. It is self-referential, it is experiential, it is dynamic, and open. It is a medium of growth and evolution. It is the medium of this issue of *The medium*.

The ecology of hypermedia: Spinning the web of meaning

A discussion on the nature of hypermedia as an authoring environment.

Hypermedia authoring: Understanding the process

This article will offer a synthesis of the findings of current research in terms of the issues relating to authoring in this new medium, and complement and supplement the findings with dialogue from interviews with elementary and post-secondary students.

Editor as author as publisher: A dialogue

The medium , in discussion with Mr. Stephen Kemp, takes a retrospective look at the dynamics of the authoring and publishing process.

The medium

An inquiry into the nature of the authoring experience in a computing medium

January, 1993

Student compositions in the medium of HyperCard

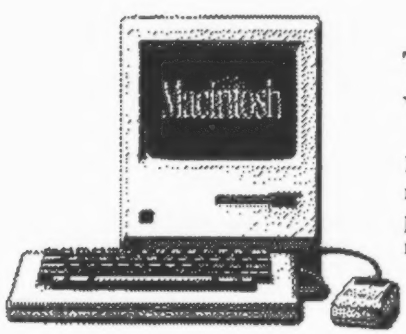
This article presents the compositions of the students from Bishop Pocock Elementary School using the computer-based, interactive multimedia, authoring environment, HyperCard.

Software Review: HyperCard

John McGrath and Jared Peace reveiw the multimedia authoring application, HyperCard. Included in the review is a description of the authoring process, and examples of the kinds of products available from the program.

Software Review: MacRecorder

Abigail Dy, who used this sound generation and editing application frequently in her compositions, provides an overview of an exciting enhancement to multimedia authoring.



The nature of multimedia authoring
Volume 3, Number 1

In this issue of *The medium*, we will explore the broader context of meaning in education, looking at the nature of the authoring process, but also at the nature of teaching and learning and researching.

The nature of multimedia authoring: Spinning the web of meaning

Using a metaphor employed by a small group of students, this article begins the process of trying to understand the nature of multimedia authoring.

Understanding the process of teaching

This article describes the elements, processes and relationships in the process of teaching. A paradigm will be developed which will look at the medium of teaching, the messages which emanate from that medium, and the meaning of those messages. A paradigm of the nature of the teaching process will be developed, incorporating the work of Erik De Corte (1990), and using examples from the comments of elementary school students as well as my reflections of the roles I played during that process.

The medium

An inquiry into the nature of the authoring experience in a computing medium

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Understanding the process of multimedia authoring

This article describes the elements, processes and relationships in the context of computer-based, multimedia authoring environments. A paradigm will be developed which will look at the medium of multimedia authoring, the messages which emanate from that medium, and the meaning of those messages. Specific examples of each will be presented from the compositions of the students of Bishop Pocock School in Saskatoon, Saskatchewan.

Understanding the nature of the research process

This article describes the elements, processes and relationships in the process of research. A paradigm of the nature of the research process will be developed, incorporating the point of viewing of a Taoist cosmology with naturalistic inquiry.

Foreword

The aim of ***The Medium*** is to provide a forum for discussion and debate concerning the nature of the authoring experience in a computing medium. It is to the description and interpretation of the nature of this authoring experience that this journal, as an on-going narrative of research conducted as partial fulfillment for the degree of Doctor of Philosophy in Elementary Education, is dedicated.

A medium is a context, an environment, a tool, a means or agency. In pursuing a course of research which sought to understand one particular medium, that of a computer-based authoring environment, it seemed entirely appropriate to describe that context in a context which had the same attributes. This journal emerged from the ground of my advisor, Dr. Daiyo Sawada, and the dialogues between myself and Drs. Roberta McKay and Milton Petruk, and became a figure in it's own right, but only to "fold back" and become a ground unto and of itself. It is a context, but also a tool, a means or agency of understanding.

In seeking a metaphor to describe and relate the nature of my journey with the students, a recursive, reflexive, reciprocal journey which I knew was going to be an open, dynamic, transactional, constructivist process, a Way, I sought a format for the dissertation which was resonant with the nature of the process itself. Thus, *The medium*. The nature of the dissertation format is iconic, for it represents that of which it speaks. It is recursive, reciprocal, and reflexive. It informs itself. It is my Voice, and the Voices of those who journeyed with me.

Stephen Kemp

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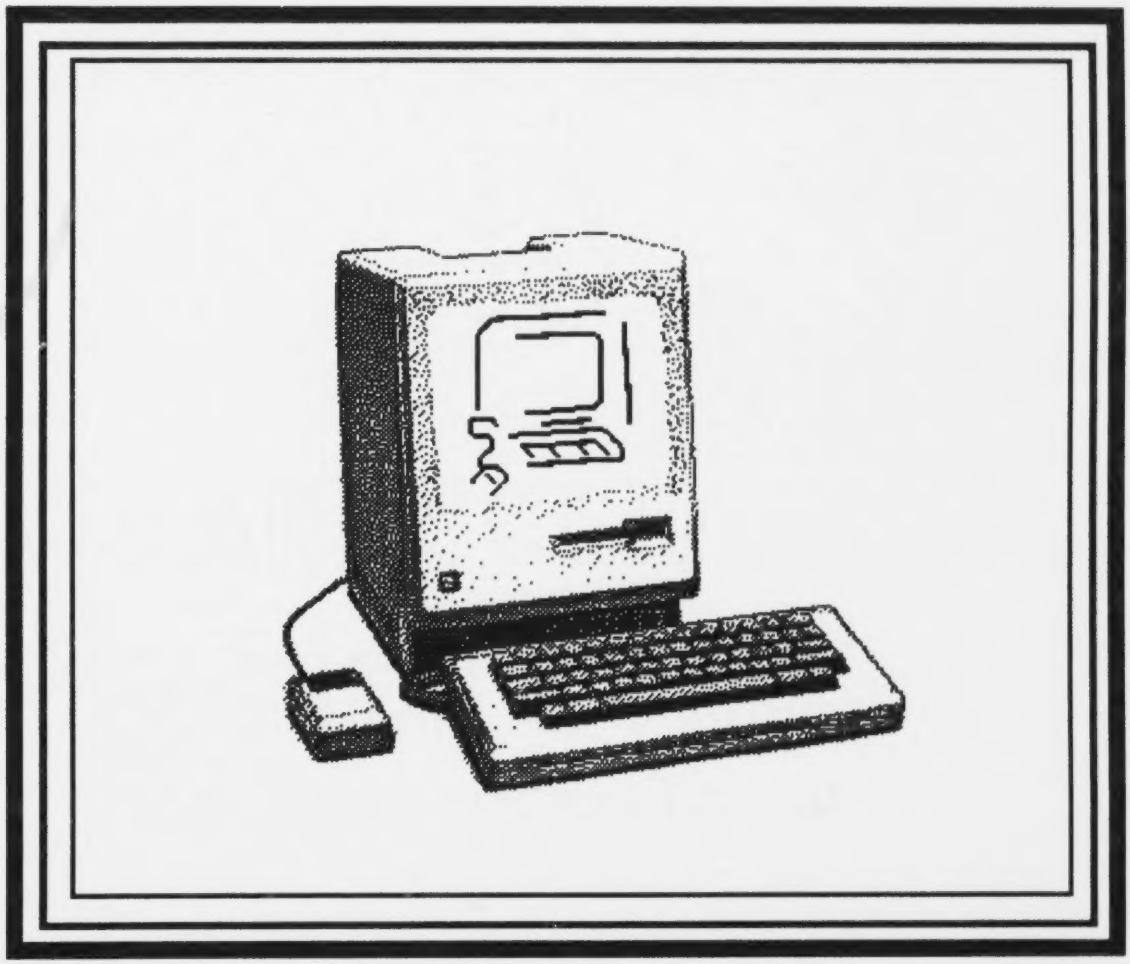

In this issue: ***Welcome to Macintosh***

May, 1992 Volume 2, Number 1

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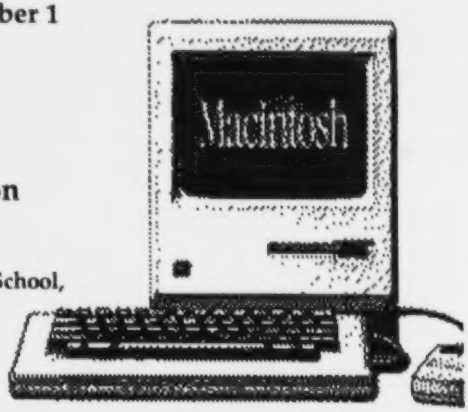

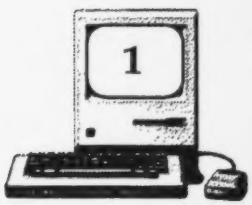

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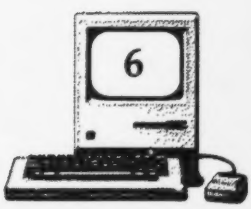

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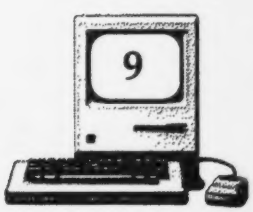

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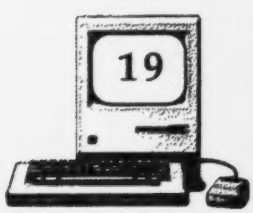

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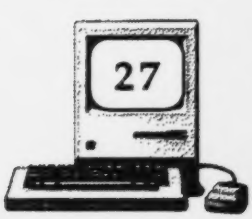

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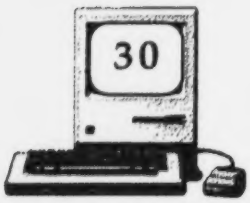

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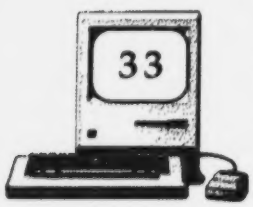

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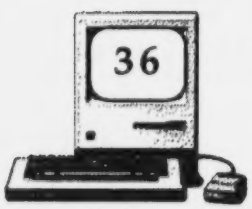

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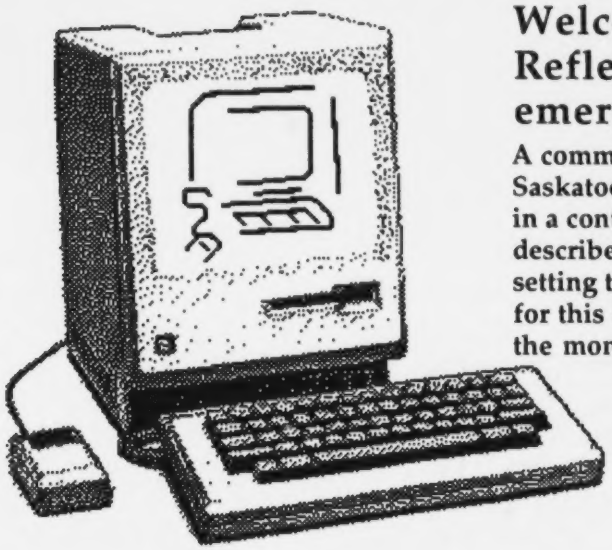

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A community is slowly emerging at Bishop Pocock School in Saskatoon, Saskatchewan, a community of learners engaged in a continual process of growth and change. This paper describes this community, it's elements and attributes, setting the context for the discussions that will follow both for this issue of *The Medium*, and those that will follow in the months ahead.

I posed the question to my grade 8 students, who, after 8 weeks, had assimilated the Macintosh operating system, 3 graphics packages, and were now "devouring" PowerPoint, a multi-media application which allowed them to compose on-screen slide presentations.

"Have any of you noticed the greeting when you turn on the Mac?"

"Do you mean the banner that says something like Macintosh Installed?"

"No, not exactly, that's MacJanet Installed, and that just informs you that you are connected to the server and can logon to the network."

"Oh, you mean the screensaver and the disinfectant icons?"

"No, those icons represent 2 of the inits that I have installed in the system folder. I was thinking of the banner that greets you when you first turn the computer on, it's in the middle of the screen."

"Mr. K, are you asking about the little disk with the question mark that turns into a happy face when you put the startup disk in?"

"No, right after that, what greeting appears?"
"Oh, I know, it says Welcome to Macintosh, right?"

"Yes, that's the one, Welcome to Macintosh. Has anybody thought about what that means? What does the term Macintosh mean when used that way in the greeting?"

"It sounds like a place, you know, like, Welcome to Saskatoon, or Welcome to my place, or something like that."

"Uh huh."

"To me, it's a way of doing things, like with the mouse, and pull-down menus, and windows and clicking and dragging and double-clicking on stuff to open them."

"A way of doing things, interesting!"

"But I thought it was just a way of greeting you, to make you feel comfortable, you know, like it's going to be fun and stuff."

"Could be that too. There's no one right answer, I was just wondering if any of you had noticed the greeting and wondered what it might have meant, that's all. It just seems to me that it is a very special message, I think that whoever designed the Macintosh and the way it works was trying to tell us something about how they thought that this computer could be a good place to work, a good thing to use, maybe even a special way of thinking about how and why we are using the computer. After your groups today, I'd like you to reflect in your journals about what the greeting means to you. What does it mean, Welcome to Macintosh?"

I could tell by the glances upward that I was intruding on their computer time, and that they were anxious to begin. Group 1, a collection of 7 boys all of whom were very close friends, bright and imaginative, gathered up their journals and data diskettes and noisily bundled out of the room to the lab down the hallway. Groups 2 and 3, a combination of boys and girls grouped together on the basis of their math projects, instinctively took out their assorted notebooks and materials and prepared for the day's activities.

"Group 1," I reminded them as they disappeared, "you've got until recess, that's a little under 45 minutes."

Jason approached me. "Mr. K., can you come down and show me how to get my picture from MacPaint into PowerPoint? I want to use it in one of my slides."

"I can't right now, Jason, I've got to get these two groups going, but, have you saved a graphic already?"

"Yes, it's on my disk."

"On the server?"

"No, right here, my own."

"Okay, well listen carefully. You can't Open the file, so pull down File, highlight Paste from, click on Drive until you get the Startup in the window, then Eject Startup, insert your datadisk, and double click on your graphic name."

"Oh, yeah, okay, it's Paste from, right, not Open?"

"Right, try that and I'll check on you in a little bit, or ask Mikey for help because he did that yesterday I think, so check with him, okay?"

Welcome to Macintosh! Welcome to our issue on the nature of

one specific medium, the Macintosh computing medium: a place, a machine, a way of thinking, a way of doing, perhaps even a way of Being. As the first issue of ***The medium*** devoted to the unfolding narrative that is my research project, I would like to discuss and describe the context, not only of the medium that is Bishop Pocock School in Saskatoon, Saskatchewan, but of my grade 8 classroom, my students, the authoring environments, and the nature of one aspect of the authoring experience in a computing medium.

Bishop Pocock Elementary School is located in a relatively affluent community on the east side of Saskatoon. The school, which was built in 1977, has 225 students enrolled in Kindergarten through to grade 8.

My grade 8 classroom is composed of 22 students, including 8 girls who form a very cohesive, tightly-knit group. The 14 boys are divided equally into two distinct groups: one group is made up of 7 boys all of whom have attended Bishop Pocock since Kindergarten and often reflect very similar interests and talents; the second group is very diverse in talents, background, culture and interests.

As their teacher, I am assigned to teach all subjects with the exception of French, Music, Health, and Art, consequently, I am in the classroom for approximately 85% of the regular school week, with the remaining 15% constituting my administrative release time as vice-principal.

We are fortunate to have a MacJanet network featuring 8 Apple Macintosh Classic computers networked to a server with an internal 30 megabyte hard drive. However, because of the number of other classes who use the lab, each student stores all of their own work on individual 3 1/2" high density diskettes. Installed on the network are several categories of applications including Graphics (MacPaint, MacDraw, SuperPaint, and Adobe Illustrator), Word Processing (Microsoft Word, Works, MacWrite), and Authoring environments (HyperCard, PowerPoint, and Authorware Professional).

Figure 1: Bishop Pocock Elementary School

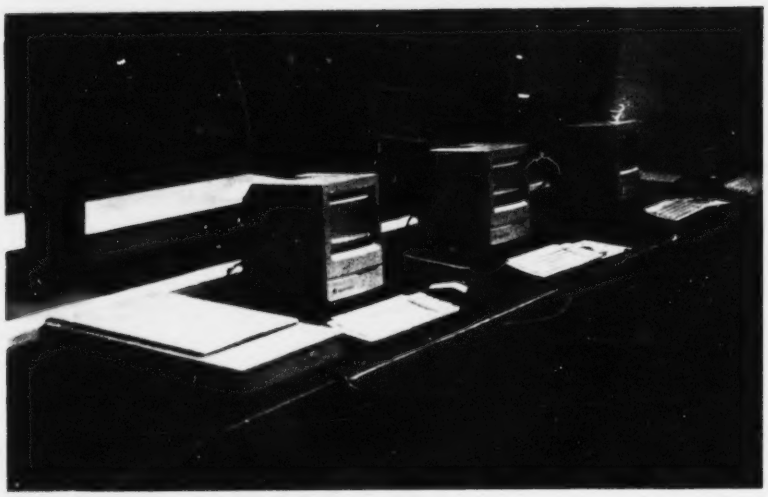


Figure 2: The Computer Lab

Our journey together began in late August. It was my intention to introduce the students to the Macintosh operating system through a series of short, intensive, demonstration-type lessons in which the students worked in groups of 3. However, after the first half-hour session, it was readily apparent that even though only one of the students had previous experience with the "Mac", these students were very receptive to the use of the mouse, and manipulation of pull-down menus and windows. Consequently, the second lesson was devoted to the Logon procedures onto the network, and then straight into the basic operating functions and facilities of MacPaint, a graphics program. It was my decision to use MacPaint as an introductory application because of the incredible drawing ability which the students had demonstrated during several assignments and projects in Art, Language Arts, and Science. In addition, it was typical of the direct manipulation interface employed by all Macintosh programs, and so I decided that it would be a perfect place to begin introducing the students to the Mac environment. This decision was easily confirmed by their first attempts at drawing using MacPaint, and illustrated by the quality of their artwork in the PowerPoint compositions which are described and presented in this journal.

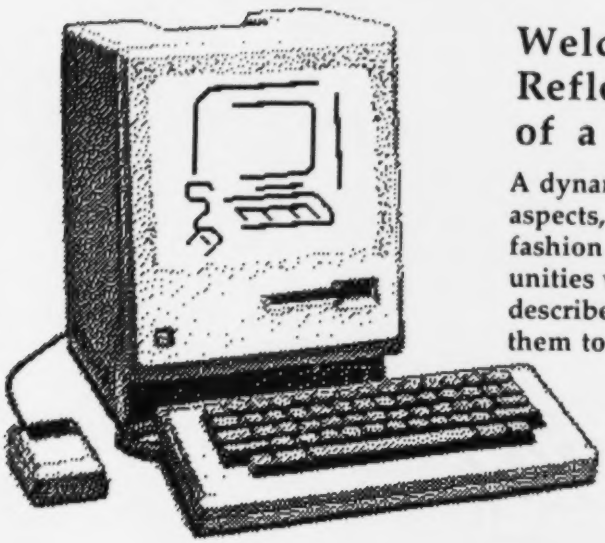
The MacPaint experience lasted for most of September. We had scheduled 3 afternoons per week, Monday, Wednesday and Friday, and established a rotational schedule such that each group of 8 students had approximately 2 hours per week of "on computer" time. During the month, I attempted to focus their experimentation by requesting a title page be created in MacPaint for inclusion in the novel study of Jean Val Jean. Each student was asked to incorporate as many of the functions and facilities of MacPaint as possible in their design and development of their title page. During this time, the students were grouped according to their Math groups which had been

established on the basis of their project work in Math. In the case of the 7 boys who formed the very tight social group, coincidentally, they also formed a single math group, all of whom were exhibiting very strong skills and understandings in Math. The other two groups were composed of a mixture of the remaining 7 boys and the 8 girls. By the beginning of October, we were ready to begin the second step in the developmental process, that of learning and composing in the multimedia application, PowerPoint.

PowerPoint allows for the creation of an on-screen "slide show". The students were able to incorporate text, graphics, and commercially prepared EPS Clip Art (public domain graphical images borrowed from my colleagues in the Department of Educational Communications at the University of Saskatchewan). Again, the first step was to demonstrate the basic operating functions of PowerPoint, and then allow for individual exploration in the design of a simple 3 frame slide show. After this introductory exercise, the students were asked to compose a production on the same topics as they were researching for another assignment in "Social Studies". My assumption was that after having already accumulated a body of knowledge during the research process for their projects, that they would be able to turn their attention to a unique approach in the articulation of their knowing. This project was completed by the end of October, when I offered them the possibility of composing another production in a randomly mixed grouping arrangement. Their initial reluctance (based on the tightness of their social groupings) was quickly overcome, however, and the productions which are displayed herein are testament to their collective, creative energies.

We have now started the third phase of our journey, HyperCard. However, it quickly became clear to me that while each of these first two phases of MacPaint and PowerPoint were unique and merited investigation and discernment as entities in their own right, they could not be disassociated because of the recursivity inherent in the entire process. From the MacPaint medium that was purely graphics, the process evolved into PowerPoint compositions incorporating both text and graphics, graphics which were either personally created or incorporated from commercial sources. In addition, the first step into authoring was begun, compositions in a "slide show" format, but compositions which nonetheless exhibited a clear design and development process.

This issue of ***The medium*** is a reflection on the nature of our journey to this point in time, a snapshot of an emerging community, a community of authors and composers in a new medium, employing tools and processes in the articulation of their experiences in a new and unique medium. ***The medium*** has grown into a melody of Voices, the collective Voices of my new community as we journey together.



Welcome to Macintosh: Reflections on the nature of a computing medium

A dynamic medium has, at all points in it's evolution, two aspects, each of which must work in a complementary fashion to maintain the poiesis, or creative growth of the unities which exist as part of that medium. This paper describes those internal and external aspects, and relates them to the Macintosh computing environment.

The essential nature of all media is activity, process, change (Weaver, 1985, p. 345). A dynamic medium has, at all points in its evolution, two aspects, each of which must work in a complementary fashion to maintain the poiesis, or creative activity (Carse, 1986, p. 64), of the unities which exist as part of the medium, not as separate objects inside it (Winograd, p. 42). Internally, the medium must be autopoietic (Maturana and Varela, 1987, p. 72), self-referential and maintaining, capable of sustaining growth and activity. Externally, the medium must be capable of acting in concert, in unison with other media, a reciprocity of interaction "such that the participating unities can preserve their individual limits, at the same time as they establish, by their coupling, a special new coherence or unity (Maturana and Varela, 1980, p. 88).

Thus we have two aspects, an introspective, reflexive, self-referential process which maintains the unity of the system through recursive interaction (Sawada and Olson, 1986, p. 12), and an external correspondence (Winograd, 1986, p. 34) with other media, a structural coupling by which the inherent paradox of self-referentiality is disrupted.

In reflecting on the nature of the Macintosh medium, therefore, one must consider both aspects. What attributes, or qualities exist in the medium such that autopoiesis is maintained? and secondly, What evidence is there for a coupling with other media, in this case, the elementary school students who seek to articulate their experiences, their knowing, in, and through, the Macintosh environment?

In terms of the former, the autopoiesis of the medium is inherent in the iconicity of the elements of the environment. The symbols which express the means, or agencies, are not inert representations of processes, they are in and of themselves processes whose very actions are represented by the nature of the symbol. Symbols are representations, but icons are

embedded, levelled, self-referential symbols that can be "experienced". In this context, icons become tools for more icons, which in turn become tools for more icons, and so on. As an example, the graphic display which greets the user includes the representation of a garbage can, the Trash icon, and the process of removing a document from a window or a disk from the drive is to drag its iconic representation over to the Trash and so thereby delete it. Similarly, the representations of disks, and folders, and documents are themselves iconic, for "double-clicking" on any of the above reveals it's contents, or activates a selected process, which in turn is another icon for yet another series of processes or activities. The fundamental icon is the language, both textual and graphic, which is the articulation of the experience or knowledge of the author. The explicit, and inherent iconicity of the environment is extended into all of the applications which reflect the Macintosh operating system, as in the Tools menu of MacPaint, or the functions window in PowerPoint. Thus the introspective, reflexive, self-referentiality of the medium is conserved in the degree of iconicity supported in, and by, the medium.

Externally, the medium must be capable of initiating and sustaining a reciprocal interaction with other media. The nature of this "structural coupling" must remain unique to each complementary pair, for no two media are identical. Therefore, we see in the reflections of the students a variance in the type of correspondence which each has initiated and maintained with the Macintosh environment.

The most common analogy, or interpretation of the meaning of the term, "Macintosh", was that of a place:

> Macintosh is in its own way a place. There people and machine cooperate. (Claudia)

> When you get to Macintosh, it's almost like being inside the computer. You are able to choose what you want to do. It gives you choices, and its like your [sic] in control of the computer. It means that there [sic] referring to a place, making you feel like your [sic] somewhere instead of like your [sic] there in a chair watching. (Tyler)

> Welcome to Macintosh is like someone welcoming you to there [sic] house. It is also like a welcome mat. When it says Welcome to Macintosh, its like when they have signs at the beginning of a city. Macintosh is a kind of place and it is saying that this is our place and we are inviting you in. (Carrie)

On the other hand, several students referred to Macintosh not in terms of an abstract "place", but in terms that spoke of an extension of the mind, and in one case, of the extension of the soul, their Being:

> Macintosh is a place of the future, a place of learning, of advanced technology. A place you can let your imagination go, where you can get your ideas across in a variety of neat, fun ways. In Macintosh, you can draw pictures without the smudges, eraser marks, and tired hands that go along with pencil and paper. Macintosh is a new wave, the thing of the future, a place of better understanding and organization. The possibilities are endless if you have some creativity and a Macintosh computer. (John)

> Macintosh is a place where you are being invited to go where you can use your imagination. (Michael)

> What is Macintosh? It's a product of Apple computing, but it's also a system of thinking, a way of expressing minds. The word "Macintosh" may even seem like a feeling of fullness, or a nourishing type feeling that is found when you turn on the processor. It could be a place in which an uncertain future could have been imagined. (Lloyd)

> It's saying Welcome to our computer, our way of handling things, of getting things done, our organization [sic] techniques, our system. It means welcome to our way of life. (Jared)

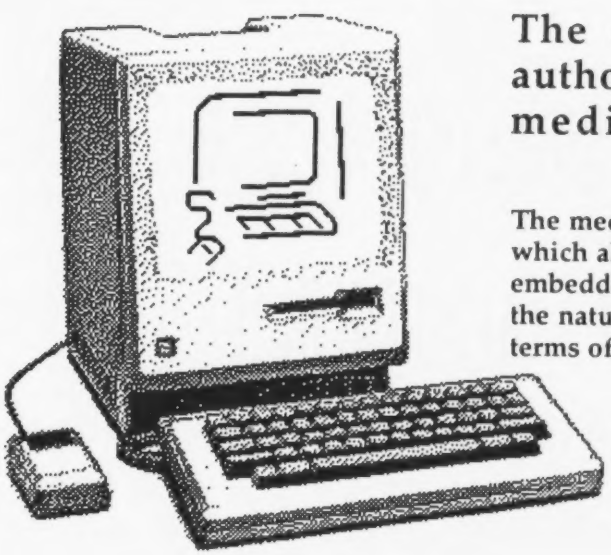
> What Welcome to Macintosh means to me is, Welcome to the Macintosh program itself. **I'm the Macintosh program**. (Curtis)

This coupling between the students and the context that is Macintosh is evident in the enthusiasm and excitement which the students displayed. Limited to but three afternoons a week, and then further limited by the group approach to the sharing of the computers, the students were often found working in the lab during recesses and lunch hours, and, when permitted, after school. Their attachment to the possibilities afforded by this new medium was exciting to watch, and participate in. New discoveries such as animation, or symmetrical patterns using the brush mirror facility in MacPaint, invoked enthusiastic responses and sharing from the other students both in the lab at the time, and in the classroom upon their return. What was interesting was that this coupling between the students and the technology was amplified in and among the students in the classroom, helping to overcome very strong social barriers and walls that are typical of adolescents. Sharing became the norm, not the exception. This was made most explicit by the outstanding

collaborative efforts which typified the group projects in PowerPoint, examples of which are included in other articles. Drawing on the strengths of each other in groups of three, the students worked with diligence, enthusiasm, and in a spirit of cooperation that was atypical of their relationships to that point. The reaction of other students, staff members, and parents, only served to emphasize the point.

Welcome to Macintosh means welcome to a medium of discovery, of exploration, of articulation, of facilitation, of Being and becoming. It is a place, a context for learning, a medium of expression, a tool of the mind as well as the hand.

As the narrative of our journey unfolds, and is told, there will be many questions, many opportunities for dialogue. It is my hope that this journal will do justice to that dialogue, that it will serve as both voice and ear, that it will become a medium for exploration and discovery.



The computer-based multimedia authoring process using PowerPoint: medium/messages/meaning

The medium is the situationalcontext in which all instances of authoring are embedded (Harste,1984). This paper describes the nature of those instances of authoring in terms of the context that is PowerPoint.

The medium is "the situational context in which all instances of authoring are embedded" (Harste, 1984, p. 10). It is an underlying premise of this discussion that a medium, a context, has two aspects: the elements of the medium are the basic building blocks which determine the shape or form by which the medium is realized or articulated; secondly, the attributes,

or qualities of the medium include those processes which facilitate the maintenance and growth of the medium. The nature of the medium, therefore, will determine the nature of the "instances of authoring". The question which emerges, therefore, is the nature of these instances of authoring when the context is PowerPoint, a multimedia, slide show presentation format, application.

The medium

Jerome Harste (1984) describes the process of authoring as a "multi-modal process governed by the search for meaning, and involving alternate expressions of language (speaking, reading and writing), and communications systems (language, art, music, drama)" (p. 215). In this sense, therefore, the elements would include those "multi-modalities, expressions of language, and communications systems", while the attributes would include those processes which facilitate, or govern, the "search for meaning". In the context of PowerPoint as medium, however, the elements as described by Harste (1984), do not all apply. The medium has changed from a multi-modal context in which modal is interpreted as art, drama, speaking, music, listening, reading and writing, to a multi-media context which includes text, art, and digitized graphics.

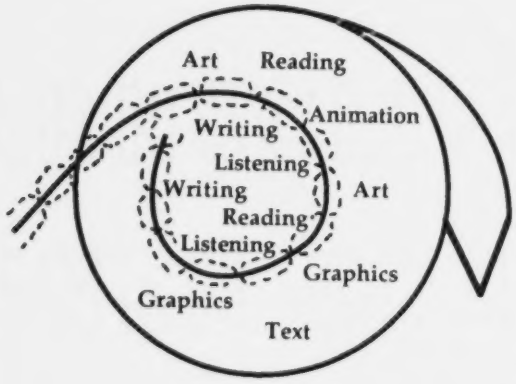


Figure 1: PowerPoint as medium

In this context, the process of authoring is one in which listening, reading and writing are now incorporated with art, animation, and digitized graphics. The nature of the medium has changed.

PowerPoint is a multi-media application that supports the production of on-computer "slide shows" in a linear, sequential, presentation format. PowerPoint has three main elements: text, art, and digitized graphics. The text options are

very similar to those of any Macintosh-based application, with the user able to select a variety of fonts, styles, and sizes. The art options are very limited, supporting only the most basic geometric figures such as rectangles and circles, as well as straight lines, and the filling of objects with a variety of patterns. There are no facilities for freehand drawing such as in MacPaint or MacDraw, and so consequently, the students, almost without exception, resorted to creating their artwork in MacPaint and then importing their graphics to be pasted into the slides of PowerPoint. The third element, digitized graphics, were a series of Clip Art images from a shareware organization called EPS. The graphics, rather crude in design and quality, were organized into categories ranging from office objects to skylines to sports to Martians. While initially very appealing to the students for use in their exploratory productions, the crudeness and limited scope of the images forced most of the students to resort to their own creative abilities for their final, group productions.

Within the context of the Macintosh operating system, PowerPoint supported the use of the mouse to select from menus, pull down menus, and dialogue boxes. The basic functions of PowerPoint were all iconic in nature. However, the presentation format for the slide shows was linear and sequential in nature, providing for screens or frames of information to be displayed in the order which they were assembled or organized. One unique possibility which presented itself, and something that the students found very motivating and exciting, was the possibility of automatically displaying the sequence of frames with a very short, automatically paced delay in between frames, to simulate animation. This option was chosen by a majority of the students at some point in their exploration of the capabilities of the application.

The order of the frames could be re-arranged, but the final presentation was sequential in nature, with no possibility for interactivity with the viewer. In this case, therefore, the relationship between author and reader was limited to the personal interpretation through the senses as opposed to an environment in which the user could select or direct the presentation of the information.

The messages from the medium

The messages, or as Harste (1984) describes them, "the multitude of culture-specific contexts in which literacy events can be enacted" (p. 10), only included reports and stories. These "literacy events" are described in figure 2 below.

It is perhaps important to reflect on the somewhat "restricted" applications which the students used PowerPoint to articulate. While the medium itself promoted the autopoietic, recursive authoring process alluded to by Harste (1984), the messages which emanated from the context that was PowerPoint were to a large extent dictated to by the linear, sequential nature of the presentation format. While animation was a very important, and stimulating option, the presentations were, without exception, directed at formats which were resonant with a mode of presentation which was linear, sequential, and

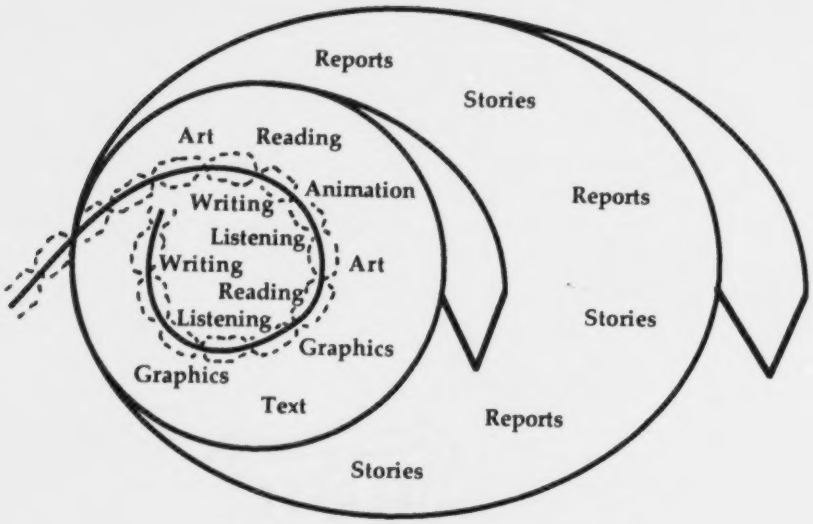


Figure 2: The messages from the medium

unilaterally determined by the author. In this context, therefore, the two messages which emerged were reports and stories, while other possibilities such as journals, newspapers, environmental print, poetry and the such were not considered. I asked several students why they had not considered using PowerPoint to create any of those media of presentation, and the general consensus was that PowerPoint "wouldn't do it right". In their estimation, reports and stories were a logical use of this type of application.

The meaning of the messages from the medium

Based on my observations, dialogues, journal records and reflections on the process which has slowly unfolded, there appear to be many fascinating aspects which have threaded themselves together in the quilt which has emerged.

1. The multimedia, computer-based authoring process is very slow.

In general, it appears that the students were able to complete one frame in approximately one hour. Given the limited size of the window in which they were composing, quantitatively this does not amount to a large volume of work. The reason for this appears to be the perceived need of the students to generate all of their graphics in the art programs, and then incorporate them into the individual frames of the slide show.

> To make the presentation took a long time, because in order to make your own pictures you had to back out of PowerPoint and get into MacPaint. Then you would draw, and zoom in and stuff like that, and then Save it, and then Quit, and then get into PowerPoint

> again, and so on. (Norbert)

Qualitatively, however, the effort which was expended into the generation of graphics in MacPaint, and the care with which the text was produced and enhanced with various styles, sizes and fonts, were ample evidence that while time consuming, the process was engaging.

> This place, like I said before, is a place for learning for sure, but it's also a place for working. When I go to Macintosh I work hard, probably as hard as anything else, because I've learned enough to do what I want to do when I'm working. It's hard, and it takes a seriously long time, but I really enjoy it. (Curtis)

2. Planning of the composition prior to writing was viewed as unnecessary.

Despite opportunities to generate outlines or plans prior to composing, the students were content to sit down in front of the computer and compose in a spontaneous, immediate mode, planning as they wrote, editing and revising as the need arose or as ideas emerged.

> Before I started my slide show I never had anything planned, I kind of just went for it, and just waited to see what it would start looking like. After my first couple of slides, I had a better idea of what kinds of things I'd like to try and do. All in all, I think it turned out great! (Stephanie)

In discussions with the students on this point, the general consensus was that the time needed to compose allowed them to reflect and consider ideas and directions.

> When I was working on a slide, sometimes an idea would pop into my head. I think it was because I was so bad at drawing that it would take a long time and I wouldn't rush so things could just happen.(Kate)

In this recursive, reflexive medium, the students were able to write as they re-wrote, to elaborate as they edited, to create as they corrected.

3. A large element of risk-taking, or willingness to experiment, was evident in the authoring process.

Shaun-Dean expressed this point most clearly, when he stated that "because it was so easy to fix up my mistakes, or change things, it was like doing your rough copy and good one at the same time". Jason added that "it was no problem fixing up stuff, so I could try a whole bunch of ideas to see if they would work". When asked if this was similar to authoring with paper and pencil, **all** students agreed that they were far more likely to experiment in PowerPoint.

4. The students impressions of the final product was that it was

significantly superior in PowerPoint than in the traditional format.

The ability to generate graphics in MacPaint, to incorporate Clip Art images, and the facility of different text styles, sizes and fonts, were all factors in the quality of the finished product being regarded by the students as being far, far superior to the traditional paper and pencil format.

> I loved it, because it looked the best of anything that I've ever done. The graphics were cool, and the words were great, we used shadow and different sizes and I couldn't believe sometimes that I was doing something that was so cool. This is so much better than regular work! My stuff in PowerPoint looks like I always wanted it to look but it never did. (Amy)

There is little surprise here, for the legibility and neatness of the student's handwriting is a constant worry on their part, and concern of mine! Therefore, to compose in a video format which removes the worry, and allows for the easy creation and editing in a multitude of styles, was aesthetically very pleasing. In terms of graphics, while all agreed that graphics added an important element to the compositions, several students considered the generation of graphics both difficult and bothersome. However, all students resorted to the inclusion of graphics to enhance their compositions.

5. The authoring process in a computer-based, multimedia environment was exciting, motivating, and personally very satisfying and gratifying for the students.

The students were, without exception, very excited about the opportunities of using PowerPoint as a medium of articulation and expression. The attributes of the process cited included the novelty aspect, the ability to try new ideas without significant effort, the challenge of using PowerPoint, and the functions and facilities supported both by MacPaint and PowerPoint. Jason listed several reasons why he preferred working on the computer rather than with paper and pencil:

> It's great for writing because there are many different styles, sizes and fonts that you can use, and for drawing you can use all of the neat features to make your drawings look really cool. If you want to animate it's easy because you can put these slides in order and then make them go to the next one really quickly, it's sort of like a moving comic strip. It makes it easier to do a project or any other stuff that you want to do, and I think it is a lot cooler and a lot more fun that just doing it with paper and pencil. The last thing is that you can save it on your data disk and you

> still have it, but if you lose your paper that your work is on or if your mom throws it out because you left it lying around the house then you have to do it all over again! (Jason)

However, several detractors from the euphoria were described, including the time element, the lack of color, and the fact that the compositions were confined to school, for none of the students had access to an Apple Macintosh computer at home.

6. Graphics, both student generated and commercially prepared, were very important in the design and development of the compositions.

While access to Clip Art quickly lost its initial interest, a reflection of the natural abilities of many of the students in drawing cartoon images of their own design, access to an art application such as MacPaint was considered by the students to be critical in providing quality illustrations. Frustrated by the lack of art options available to them in PowerPoint (it supported only the basic geometric shapes and fill patterns), the students turned to MacPaint to create their images which, in the words of Michael, "made it special, because then it was a part of you in your story".

> I usually started in a drawing program like MacPaint. I'd draw a few pictures, enough for my whole slideshow using mostly the pencil or the paintbrush. Then I would Save those pictures by going to Save...as. I would bring these pictures over to PowerPoint and add my words to it. From there I would go back to MacPaint and add the little extras or fix things up. Then I would Save them again, and then go back to PowerPoint. I pull down File, and go to Paste From. I set up my slide show in order and then watch it. When I'm done watching it I watch it again, and then I would ask my friends to watch and tell me if anything's wrong. (Jason)

When asked if graphics were considered when writing in a paper and pencil medium, the consensus was that they were not, for as Jared explained, "you have to draw pictures with words, and in PowerPoint you can say what you want with graphics". This reaction appears to allude to an awakening that the definition of writing need not restrict itself to the written text, but the definition may now include other symbolic representations in its expression.

7. Animation was considered an interesting option, but in the context of PowerPoint, was not a preferred means of expression.

While animation was considered by all students at some point in the authoring process, only 3 students used this approach to articulate their ideas. Tyler, one of the 3 students who chose animation as the

means to compose his productions, articulated most clearly the reason why it was generally disregarded, "because if you use animation by showing a slide every second, then you can't show any text and it gets kind of boring". Abigail described the process in detail:

> Animation is when it quickly switches to the next slide after the other so as if the object on the screen is actually moving. In order to make the object look like it's moving, you have to draw the object on the next slide slightly ahead (or whatever direction you want) where the object was before. It's not bad if you use the Copy feature becuase then you don't have to re-draw the picture every time, you can just Copy the graphic in and move the frame around. PowerPoint animation is cool, but very time consuming if you want to get a good one done.

In the context of PowerPoint, therefore, the crudeness of the animation process created by rapid advances of the frames was far too cumbersome and limiting to be of value to most students.

8. The ease of composition and editing was an important factor in the merit and value of PowerPoint as an authoring medium.

This aspect relates directly to the entire authoring process being far more immediate and spontaneous in the willingness of the students to experiment in their writing. Keyboarding was a non-issue, for none of the students felt that their lack of typing skills in any way hindered the authoring process. The ease with which graphics could be created, edited and incorporated into the frames, as well as the ease with which text could be edited, promoted a sense of adventurism and confidence in the students.

> Somehow to me PowerPoint's different. When you see how neat everything is displayed on the screen, and how easy it is to change things or move things around, you somehow feel relaxed and do what you want to do because it's right for you. (Tyler)

This point was alluded to time and time again by the students, particularly in reference to comparisons with paper and pencil authoring, which, according to them, was "tiring, boring and messy" (Shaun-Dean, Michael, John, Chantel).

9. The nature of the authoring medium dictated the nature of the authoring process.

Despite the fact that the presentation format of PowerPoint was linear and sequential, the attributes of the authoring process mirrored those of the Macintosh medium: recursive, reflexive, and

reciprocal. It appears that the time taken to compose and create provided an opportunity to reflect and consider, both forward- and retro-looking.

> During this time while I was constructing a slide, I thought of the next one that would be appropriate. (Derek)

> When I go to the computer I never have a real good idea of what I'm going to do, no special ideas, but when I get there and I start to work, I get ideas. It's neat because I make all the decisions, and I do all of the work. I have to make many decisions in a day, but the most fun ones are the ones that I make when I'm working because they belong to me, they're mine. (Ryan)

There was no evidence of any pre-writing activities, planning or outlining, even from students who described their traditional approach as being very deliberate and deterministic. Instead, as has been noted before, the process was emergent, reflexive, transformational, and in many cases, seemingly spontaneous. Even when afforded the opportunity to use the Storyboard technique common in the planning of audio-visual productions, all but 2 of the students stated their preference for writing as you write. Again, the novelty, ease of editing, and length of time necessary to create graphics and move graphics between applications were all critical factors in facilitating the confidence that planning was unnecessary or irrelevant. There appeared to be a considerable element of drift implicit in the process, a confidence that would allow aspects of their work to emerge, rather than to dictate the entire process prior to composing.

A key aspect here appears to be the reciprocity of interaction between the student and the technology, and between the students themselves in the lab setting.

> Macintosh is in it's own way a place. Here people and machine cooperate. (Claudia)

> Sometimes, I'd look around and get ideas from other people, or they'd see my stuff and say stuff like that's cool, so I'd keep it! (John)

On several occasions it was noted by students that new ideas were born from trying something, or bringing something back that they had saved and "fixing it up" to make it better.

> I get all my ideas from working with the computer because it can do so many neat things that when I try something it gives me ideas about how I could use it. Sometimes though I get stuck and then I ask the other people in the lab and they give me an idea and then I can get

> going again. Sometimes I go through the menus and I Open up my old stuff and then I think that I could use it and I fix it up. (Sam)

The attributes and elements of the medium itself appeared to be the catalyst for new ideas, ideas which could be tried, saved, incorporated, or discarded with relative ease. It was a dynamic and transactional medium, a visual medium of enormous possibility, a medium of exploration and articulation.

In the context of the paradigm which seeks to describe the relationship between the medium, and the messages which emanated from it, I would propose the following schematic as representative of the meaning of those messages.

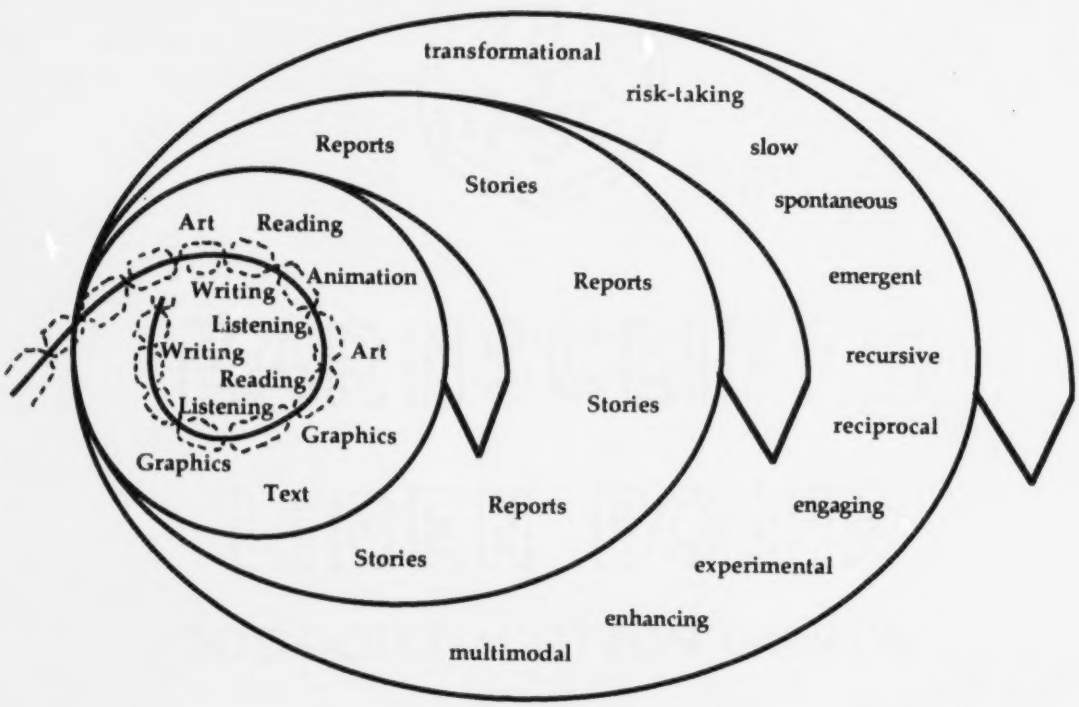
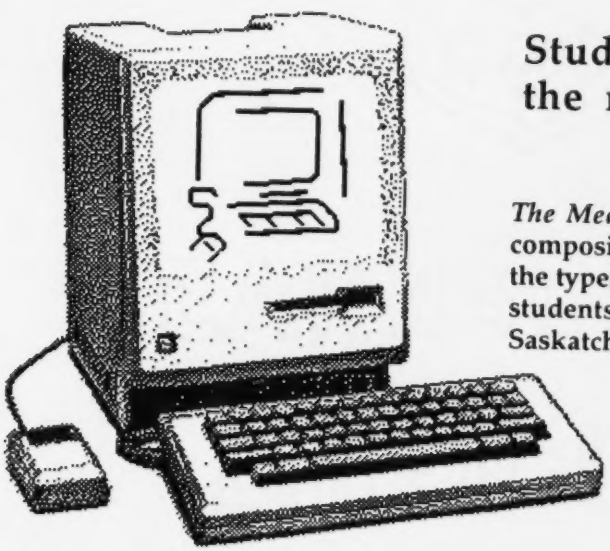


Figure 3: The meaning of the messages from the medium

Summary

In the context that facilitated the generation of text and graphics as basic elements, in a medium that was recursive, reflexive and reciprocal, the authoring process could be described as slow, emergent, trans-formational, transactional, spontaneous, experimental, exploratory, and engaging. The messages from the medium were likewise a reflection of the nature of the medium, confined to stories and reports which mirrored the linear, sequential presentation format. In the context that was PowerPoint, the nature of the medium dictated the nature of the instances of authoring (Harste, 1984).



Student compositions in the medium of PowerPoint

***The Medium* is proud to feature four compositions which represent a cross section of the types of compositions created by the Grade 8 students at Bishop Pocock School in Saskatoon, Saskatchewan.**

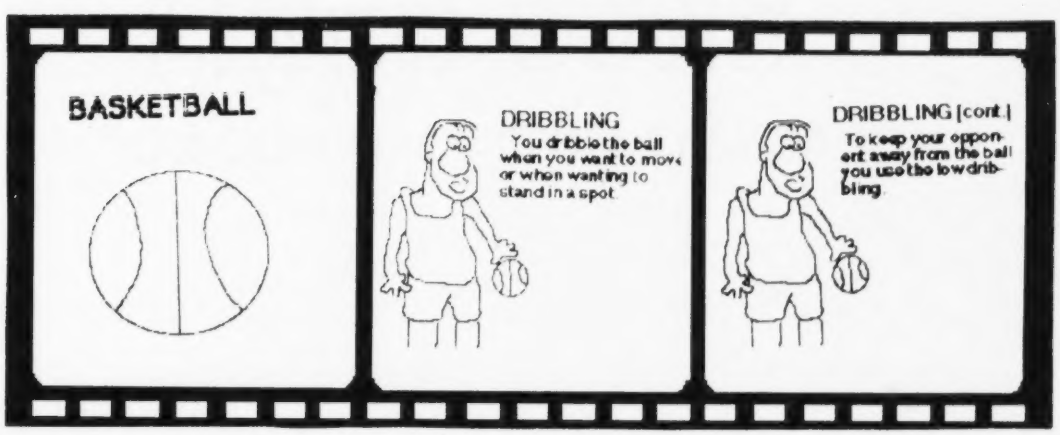
The following samples are representative of the compositions assembled by the students in their final, group presentations. The first slide show, designed by Claudia, John and Sam, is an original "fairy tale". It features the artwork of Claudia, an exceptional artist who drew all of the graphics in the composition. The text was composed by John and Sam in collaboration with Claudia.

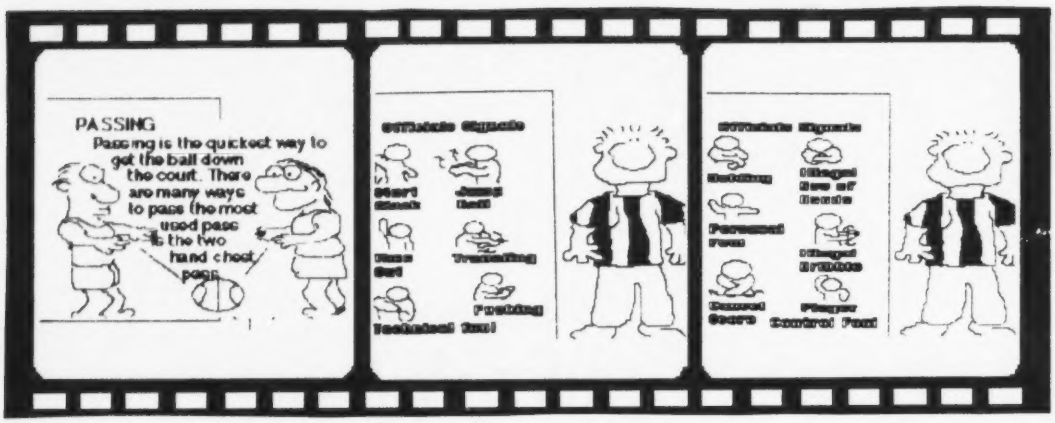
THE MAGIC BRUSH
An evil king called Theodore ruled the kingdom of Magicia. All the townsfolk loathed him and his two servants.
A little girl named Kelly was walking alone in a meadow. She found a peculiar looking brush.
She took the brush to the magic town elder. He told her that it had magic powers that would make her stronger than any man. He then told her that Magicia needed help to get rid of King Theodore.
Kelly went home and fell asleep. She dreamed of saving Magicia with her magic brush.
In the morning, Kelly brushed her and pony's hair. Then she rode towards the king's castle in pursuit of revenge.
She broke into the castle and knocked out the king and his henchmen in a fury of punches and kicks.
PUNCH
She then reigned as the queen of Magicia for many years, to the townsfolks' pleasure.
THE END

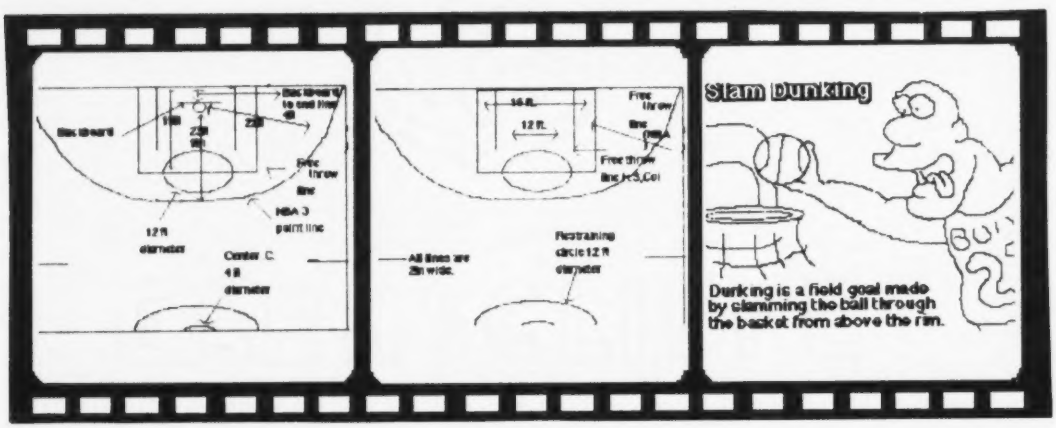
First we decided that we wanted to do a story instead of a report. Then John suggested that we should do a story in Medieval times, and that there should be a hero. We wanted a story that was different from traditional hero stories so we decided that the hero should be a young girl. Claudia suggested that her name should be Kelly. We knew that there should be some bad guys. Then we needed a plot so we chose to have Kelly save her Kingdom. To make it interesting, we chose to have a magic brush. Then we needed a happy ending, so we decided that when Kelly brushed her hair with a magic brush she would be stronger than any man. Then she would defeat the bad guys. We took nine sheets of paper and wrote out every word. Claudia drew all the illustrations for each slide. After that, Sam and John typed the words on one computer while Claudia drew all of the pictures on another computer. Then we saved the story and the pictures on Sam's disk and then we pasted them together.

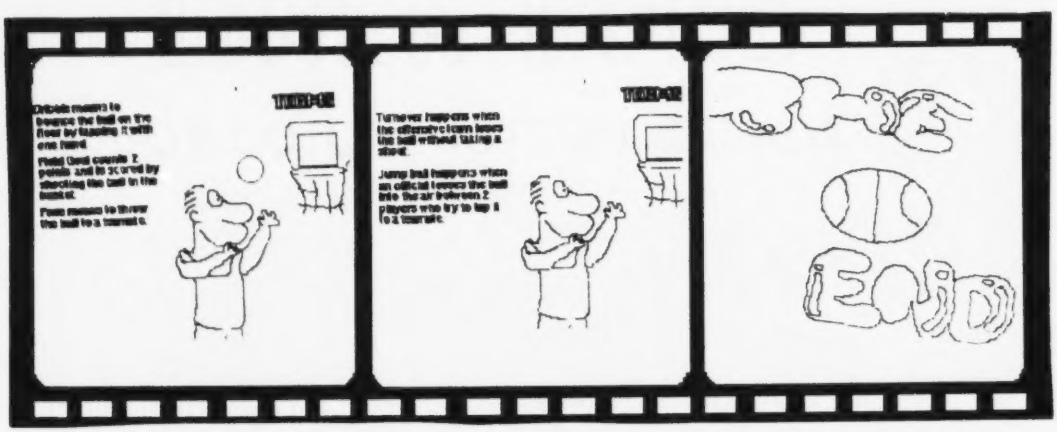
We liked the idea of having slides! It was really quick and simple because we could all do different things like drawing and typing at the same time. John liked the neatness and how it was organized. Sam didn't think that it was that much different than if it had been done on paper. John thought it was really interesting and exciting to draw on a computer.

The second sample of the student's productions is taken from the work of Jared, Norbert, and Melissa. It features excellent hand drawings completed in MacPaint and copied into PowerPoint.


BASKETBALL
DRIBBLING
You dribble the ball when you want to move or when wanting to stand in a spot
DRIBBLING [cont.]
To keep your opponent away from the ball you use the low dribbling


PASSING
Passing is the quickest way to get the ball down the court. There are many ways to pass the most used pass is the two hand chest pass.


Slam Dunking
Dunking is a field goal made by slamming the ball through the basket from above the rim.

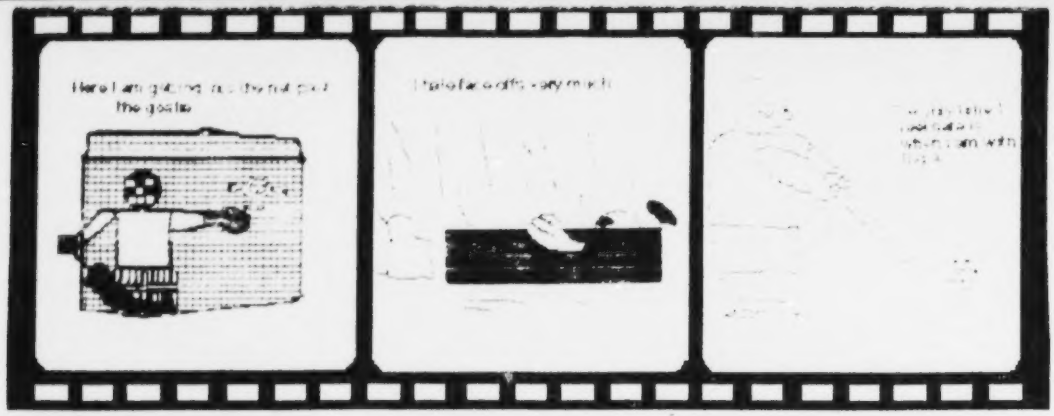


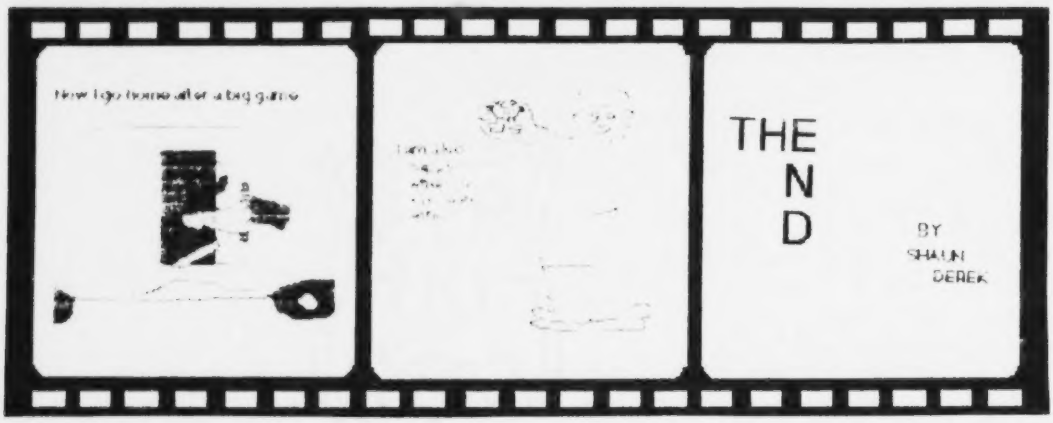
In groups of 3, we chose the topic of basketball. The idea came to mind when Melissa thought we should do a more interesting idea for the boys in the group, and it didn't matter to her! We planned it out on a storyboard first, which gave us a look of what we were going to do. The storyboards were helpful because they guided us through the process, and it helped us get our thoughts out so we could see them. Next, we went to the library and looked up basketball in an encyclopedia. We wrote the information down in the storyboards, and then figured out the pictures we were going to draw. After we had finished planning out our presentations on the storyboards, we began working in PowerPoint and MacPaint. We went into PowerPoint and wrote down all the information we found. Then we went into MacPaint and drew all of the pictures for our presentation. The pictures we included were drawn free hand. We then had to make a few adjustments on our slides because the writing was too small. After everything was all done, we drew a slide that said, "The End".

We all worked equally together drawing pictures and writing out the information. Working together was not always that easy because at some points we had different ideas and suggestions. For example, two of us wanted to do a research project on basketball, yet one of us wanted to do more of a story and less of a research project. We had to decide so we just said majority rules.

Jared liked using PowerPoint because you can make a slide show. Jared liked to work in groups because you can split the work between all of us. Melissa enjoyed working in groups because the work was divided among the three of us which made working easier instead of the work being pressured onto one person. Norbert enjoyed doing only some work which was less than working by himself.

The third composition is that of Derek and Shaun-Dean. They collaborated on an interesting approach to describing the game of ice hockey using a cartoon character they remembered from days gone by.



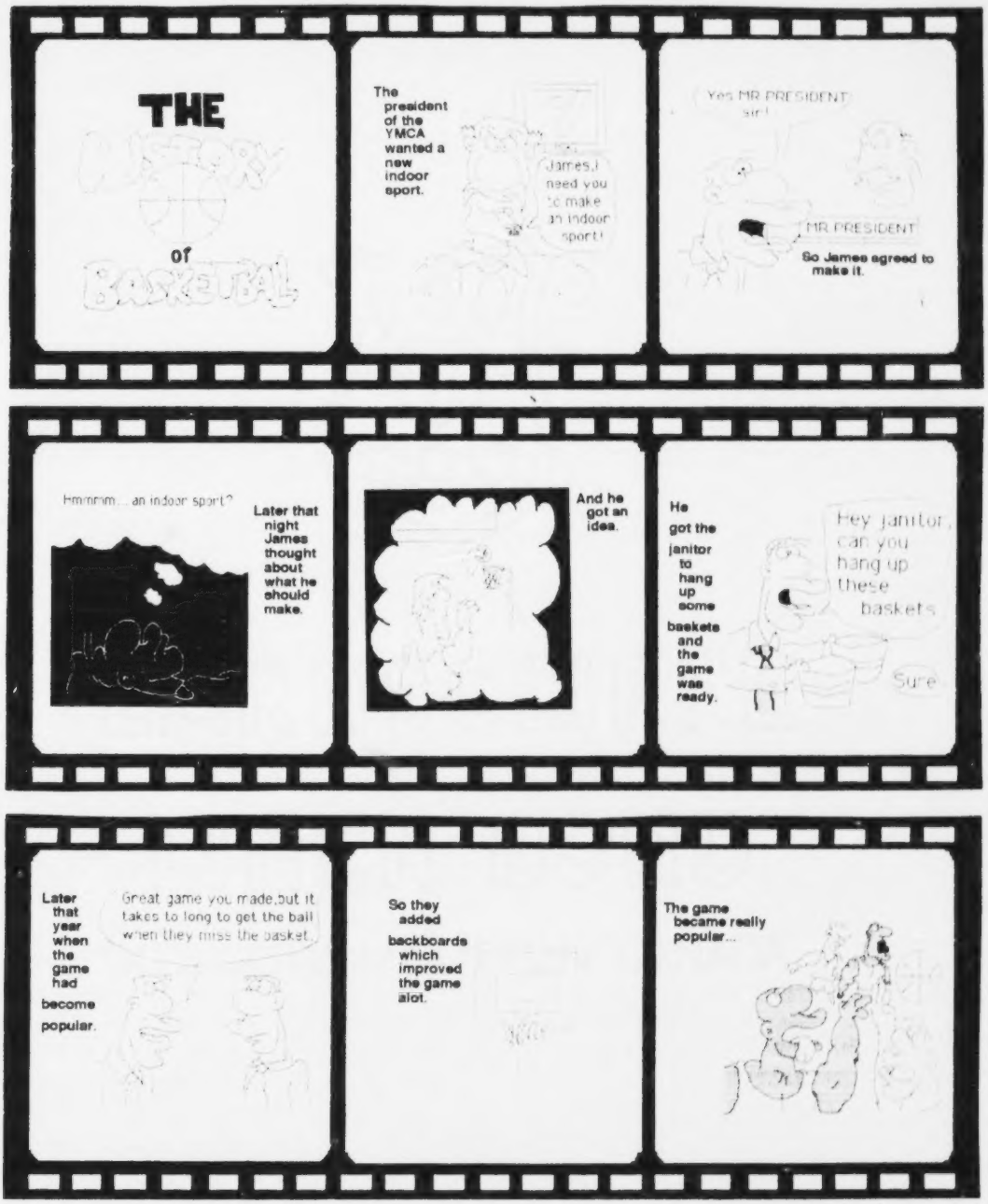


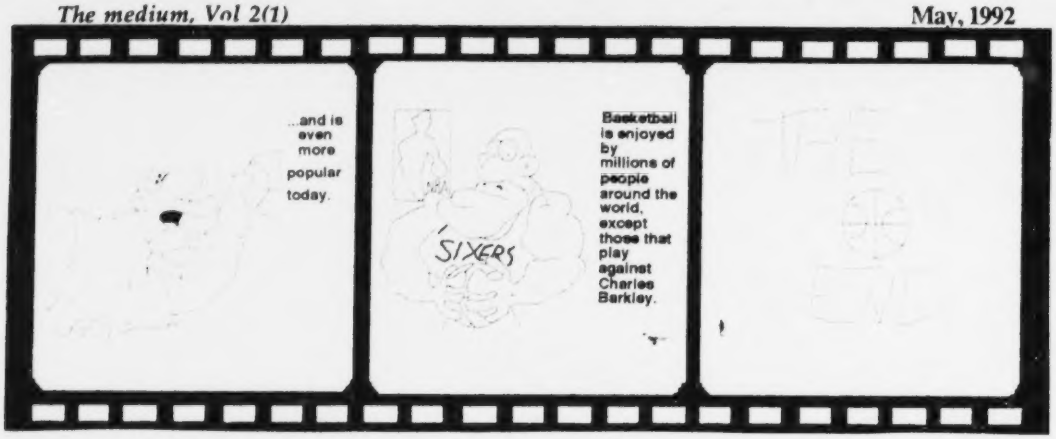
One day while Shaun-Dean and I (Derek) were in the library, we found a book on Peter Puck. We decided to do our PowerPoint slide presentation on the life of Peter Puck. We researched what Peter Puck did before games and during games. We took a couple of ideas from the Peter Puck book to make our slide show. Then we made a couple of slides. We were going to make our outline on storyboards so we would have an idea of what we were going to do before we went on to the computers, but we decided it was just as good to make it up as we went along. Shaun-Dean drew and wrote the first half of the slide show on the storyboards. I went home and drew and wrote the second half. I came to school and showed Shaun-Dean my slides. He thought they were good and so then we decided we were ready to work on the computers.

On the computers, Shaun-Dean drew most of the pictures in MacPaint and pasted them to PowerPoint. I did some pictures but I did all of the writing for the slides using the text box in PowerPoint. We did all of the pictures first, and then the writing.

We enjoyed working together rather than working alone because we found out that our finished product was much better than if we had done it by ourselves. We also enjoyed working as a group because the project went faster. We enjoyed drawing all of the pictures and combining them to make a slide show.

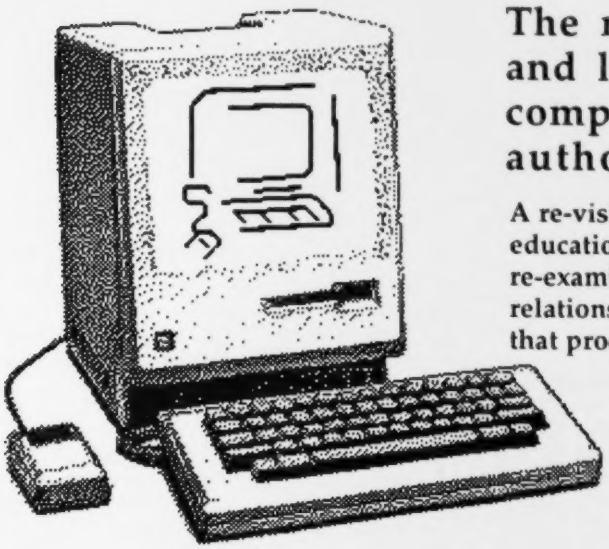
The fourth composition was created, designed and developed by Michael Fernuk, and illustrates the creativity, imagination, good humor, and outstanding use of hand drawn art work which is characteristic of all of Michael's compositions.


THE
of
BASKETBALL
The president of the YMCA wanted a new indoor sport.
James,I need you to make an indoor sport!
Yes MR.PRESIDENT sir!
MR.PRESIDENT
So James agreed to make it.
Hmmmm... an indoor sport?
Later that night James thought about what he should make.
And he got an idea.
He got the janitor to hang up some baskets and the game was ready.
Hey janitor, can you hang up these baskets
Sure
Later that year when the game had become popular.
Great game you made,but it takes to long to get the ball when they miss the basket.
So they added backboards which improved the game alot.
The game became really popular...


...and is even more popular today.
SIXERS
Basketball is enjoyed by millions of people around the world, except those that play against Charles Barkley.

My slideshow or the idea for my slideshow first came from two facts straight out of our school encyclopedia. Using the facts from the encyclopedia I decided to make a story instead of just a report. I couldn't figure out how to make a story long enough by just using total facts. The encyclopedia gave me most of the facts and the basic storyline, like how the President of the Y.M.C.A. told the inventor of the game to make a sport for winter and how the game later adopted backboards. I still had to make some things up, for example, I had to make up how the inventor of basketball got the idea for the sport through a dream, and how a friend of the inventor pointed out how the game would be better with a backboard for when people missed the rim. After I had put the actual information and the made-up information together to make a good story that made some sense, I was able to start working on the computer.

I started working in MacPaint because I felt PowerPoint's tools were too limited. I drew about five pictures in MacPaint. These pictures included the actual graphics as well as any speech that was inside the picture, such as words in speech bubbles. Then I would transfer these pictures to PowerPoint. In PowerPoint I wrote the words on the side that told the story. Before I had done any of this work in PowerPoint and MacPaint I had a pretty good idea of what I wanted to draw and what I would write, but I didn't need to use storyboards because I was able to fill in little details as I was working. After I did my work in PowerPoint I went back to MacPaint and went through the same process. The only reason I used this process was because after I had drawn a picture I always thought of the perfect thing to write after I had drawn the picture. So, if I drew too many pictures in a row I would forget what to write. After I had finished all my slides, I had nothing to do because my slides were in the right order and I felt they were as good as I could do. I made it into a slideshow, I was happy with it the first time, and then I was done.



The roles of technology, teacher and learner in the medium of computer-based, multimedia authoring

A re-vision of the role of technology in the educational process necessitates that we also re-examine our concepts of the roles of, and relationships between, the 2 key elements in that process: the teacher and the learner.

Multimedia authoring in a computing context represents a radically different role for technology in the educational process. No longer confined to the realm of an informational-delivery system, recent developments in the hard- and software available afford an environment for exploration, discovery and articulation, a "person"-alized medium for the expression of experience and knowledge. This re-vision of the role of technology in education necessitates that educators also re-examine the conceptualization of the roles of the 2 key elements in that process: the teacher and the learner.

A perspective on the role of technology is an elaboration of the underlying philosophical assumptions made by the educator. To regard technology as a communication device by which the transmission of information is made more efficient from teacher to learner is to consider education as a deficit-reduction model. The educator knows something that the learner does not, and if the instruction is planned systematically with due regard to maximizing the efficiency of the operation, then information can be communicated, effected, or elicited as appropriate behaviors from the learner. Technology serves to enhance this prescriptive, systematic, deterministic process by making it more efficient either through increasing the volume of information transmitted, or as a management technique to ensure that what was transmitted was received. Instruction becomes the arrangement and management of information. In this perspective, the role of technology is that of a means of communication.

On the other hand, technology as context implies a perspective on education that seeks to facilitate, promote, reciprocate, and maintain a dialogue between two aspects of a single unity. Technology as medium

connotes something completely different, a means or agency indeed, but a tool, a way of doing. Technology as context speaks to exploration and discovery, articulation and experience. Multimedia, computer-based authoring environments, therefore, represent a new, radically different approach to the notion of what constitutes the role of technology in education. This role is predicated on a philosophy of education which views teaching and learning as dynamic, emergent, reciprocal, transformational and experiential.

From my experiences these past few months working with and for students who are in the process of engaging this new medium for the first time, the role of the teacher in this context has likewise undergone a metamorphosis. I was no longer the arranger of the classroom, determiner of the direction, creator of the program, or manager of the process. In many ways I was an outside observer, one who served as a catalyst, but then receded into the ground as the figure that was the learner began to emerge.

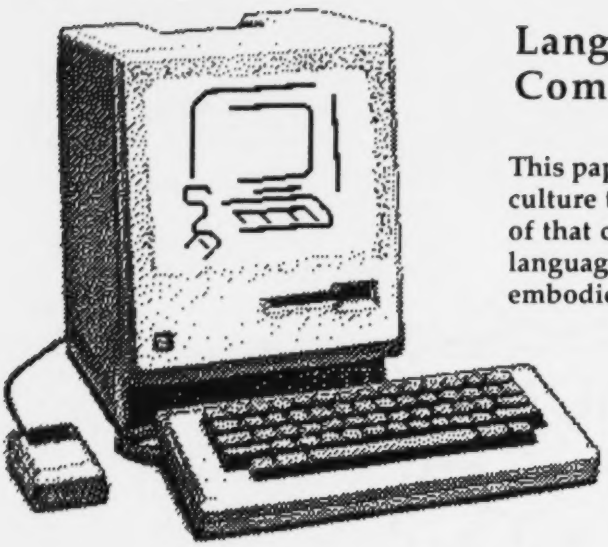
> Our teacher, Mr. Kemp, was very helpful and patient in teaching us how to use the many different ways and ideas of doing things, and also suggesting how we might improve. Sometimes we did it our way anyways because we thought it was better! (Stephanie and Chantel)

Shortly after my initial demonstrations of the functions and facilities of the applications, it was now my place to support rather than to supply. The students were free to experiment and explore on their own, often discovering new capabilities that I was either unaware of myself, or had not considered important enough to warrant noting for the students. I was asked for help but rarely felt the need to initiate suggestions, preferring instead to watch and listen, and then, hopefully sensitively and perceptively, offer a comment that might extend or elaborate on what the student was doing. It was, upon reflection, mostly re-active in the sense that I rarely felt the need or desire to direct the progress of the student. Things happened, and I provided suggestions, hints or comments to promote the growth of the experience. With the exception of the first demonstration of each application, or at specific instances thereafter to add important facilities such as saving files, copying and pasting graphics or combining elements in a production, I never had the spotlight focused on me. Instead, I worked with individual students most of the time, giving advice where and when needed, occasionally offering to gather a small group of students together who I felt might profit from sharing the same moment. The responsibility for disseminating information was gone, instead, I was asked for help on certain topics that the students were working on and needed at that particular time to complete a frame or sequence of frames. More often than not, I was the learner, a medium coupled in a dynamic, active, transactional, reciprocal relationship with the other students.

The roles of the learner evolved as their experiences and confidence

grew. In discussing with the students their impression of the experience of using MacPaint and PowerPoint, they spoke of creativity, activity, patience, thoughtfulness, experimentation, frustration, involvement, attentiveness and connection. It was obvious that the novelty of this new experience heightened their enthusiasm and motivated them to persevere and overcome the initial frustrations. But the novelty soon wore off, yet the student's enthusiasm and interest grew instead of waning. Norbert, for example, estimated that his 20 slide production took him over 16 hours to complete! This is not forced obligation! Their engagement to the task, their surprise and delight, indeed, their pride in what they had composed, was evident in every student. The figure that emerged from the ground was a figure in it's own right, a learner that was confident enough to assume control and responsibility for their own learning, to write their own story, to stretch, explore and extend themselves.

Frank Smith (1981), in seeking a metaphor for language processing, described the brain as "an artist, a creator of experience for itself and for others, rather than as a dealer in information" (p. 118). In the context of computer-based, multi-media authoring , I would like to suggest that this same metaphor might apply equally as well to technology. In this sense, the technology as artist is painting a new picture of education: two elements, a recursive figure whose ground can be seen as a figure in its own right (Hofstadter, 1979). The figure in this context is the learner, the ground, the teacher.



Language, Culture and Community

This paper seeks to describe the emergence of a culture through the dialogue between members of that community, and the development of a language unique to that community which both embodies and maintains the culture.

I was working in my office adjacent to the Macintosh lab, when Curtis knocked impatiently at the door.

"Mr. Kemp, how do you fill an object with a pattern?"

"Are you in MacPaint or PowerPoint, Curtis?"

"PowerPoint."

"Okay, that's different from MacPaint, because in PowerPoint we are working with objects so you can't use the PaintPot icon. Okay, first click on the arrow icon from your menu on the side, okay?"

"Uh huh."

"Then click on your object to be filled, and you should see a frame around it, right?"

"Okay, click on the object, oh yeah, then you get the frame."

"Right, now go to the menu bar, and pull down Draw. You should see an option that says Filled. Highlight Filled. Then pull down Draw again, and this time choose Patterns. You'll get a sub menu, so slide the mouse across, don't release the button, and highlight the pattern you want. The object should be filled with the pattern you selected. Okay? Now if you want to choose another pattern, just pull down Draw again, as long as it's framed you can keep changing the pattern."

"Thanks Mr. K."

The other occupant of the room, an itinerant French teacher who shares my office, stared dumbfounded at me as Curtis left the room.

"What on heaven's earth were you two talking about?" she asked.

"Oh, Curtis just wanted to know how to fill something he had drawn on the computer with a pattern," I replied nonchalantly.

"I didn't understand a word you said, you might as well have been talking a foreign language! And this from a student who does not take French because of his difficulty in grasping the vocabulary and concepts!"

For the first time it dawned on me that our community had evolved, and as it grew, so a language and culture were emerging. This culture was one based on a new medium, a new context for learning, a new means of articulation and expression. Implicit within that new means of expression (which included text and graphics and art work), a language had emerged, unique to that context, and so therefore unique to the community which now supported and maintained it. Language, culture and community. The three seemed inextricably linked. My reaction was identical to that of Oliver Sacks (1989), who, in describing "Seeing Voices: A journey into the world of the deaf" wrote....

> But almost at once I was to be made aware of another dimension, another world of considerations, not biological, but cultural. Many of the deaf people I met had not merely acquired good language, but language of an entirely different sort, a language that served not only the powers of thought (and indeed allowed thought and perception of a kind not wholly imaginable by the hearing), but served as *the medium* of a rich community and culture. (p. x)

This language had been borne from the medium that was the Macintosh computing environment, with vocabulary and concepts specific to that environment. I was perfectly able to understand Curtis, as I am sure are those readers among you who routinely work with such technology. But this language was alien and foreign to the outside observer.

Driven by, yet at the same time continually re-defining the language from which it has emerged, the culture is beginning to evolve from within and expand to include other members and incorporate other aspects of languaging. This language is common among the students from other classrooms, an extension into worlds that I personally have not touched. Instead, the students, in working with Care Pairs (a coupling of senior students with primary children), on the playground, in the gym, and on their way to and from school, have assimilated this vocabulary and made it their own. It is a language rich in metaphor and analogy, of action and engagement, and the students in the community

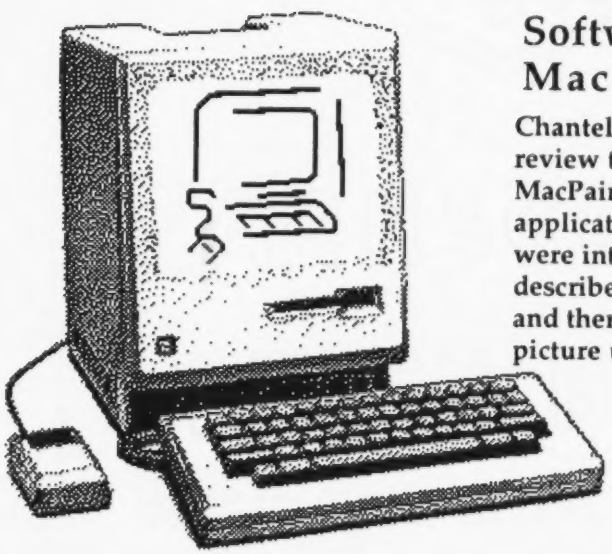
have claimed it as their own. Each group was able to communicate clearly and consistently. It was not uncommon to hear the terms Save, Pull Down, Highlight, Copy, Paste, Fill, Zoom, and so on, fill their conversations and dialogues. Each member knew what they meant, and with no hesitation were able to incorporate them into "everyday speech". These smaller communities of three were but smaller aspects of the larger community, and from within there was beginning to emerge a new, unique culture, a techno-culture of doing and articulating.

There is definitely a status attached to knowing all of the features of a particular application, and those students who either have some computer expertise from home, or acknowledged by the community as "knowing" have a respect which often contradicts their normal peer status. This was most evident in the group projects which culminated our PowerPoint experience. Despite very strong, historic and durable peer groupings (and therefore attitudes and expectations), the ability to work effectively with PowerPoint gave several members of the community a new, elevated status. People were recognized for their "computer abilities", and the initial trepidation associated with working with somebody from another "group" was quickly overcome. It would not be an exaggeration to say that the closeness of the classroom has been significantly enhanced and maintained by the computing experiences thus far.

Not only were the terms unique, but a mindset has developed amongst us, an approach to conceiving of ideas and concepts in a medium that is multimodal and technologically based. Our community has developed a unique culture, a way of doing, of relating. Never in my fifteen years of teaching has this been so evident and so dramatically different. I have always sought to find ways and means of actively engaging my students in their work, of having them consider options and possibilities, of doing more than rote memorization, but never has it evolved from within in the same manner and fashion! As part of our social studies program, we are studying common aspects of countries around the world, comparing them on the basis of a number of categories of interest which the students generated. These categories range from topography to economics, from recreation to tourist attractions. It was during the very first research session that I was asked first by one student, then, coincidentally by several others, if they could construct charts or graphs from the information, or draw pictures instead of listing the information in paragraph or tabular form, and even to use PowerPoint or a graphics program to present the information. This to me was evidence that their conceptualization of the collection, synthesis and presentation of information was becoming more broad, that it was evolving to more sensitively suit their needs and those of the intended audience. Originally content to simply copy and/or plagiarize their information from the almanac or encyclopedia, their focus had shifted to consider alternatives, to incorporate different media. While time did not permit us to compile the information for inclusion into PowerPoint, it has, however, served as a focus for the next step in the process

of multimedia authoring, that of Hypercard. HyperCard will allow us to create cards of information and then link those cards according to a number of different criteria. This next level will accommodate all of the experiences of the previous two, graphics and PowerPoint, and add another dimension, that of icon directed, interactive multimedia presentations. It will be to the experiences in this new medium that the next issue of ***The medium*** will be devoted.

In the unfolding narrative that is our community and it's journey together this year, a sense of community has, and is, developing in and through the technology. Perhaps first as catalyst, now perhaps as sustainer and maintainer, the experiences in multimedia authoring are serving to define a new language and culture. This language is the language of multimedia authoring, the culture one of activity and discovery, the community one of cooperation and sharing.



Software Review: MacPaint

Chantel Sawchuk and Claudia Azucena review the art and drawing program, MacPaint. This program was the first application which the students in Grade 8 were introduced to. Chantel and Claudia describe the program functions and facilities, and then describe the process of creating a picture using the program.

MacPaint is mainly for drawing and getting used to the idea of menus and using the mouse. The menu consists of File, Edit, Goodies, Font, Style, Patterns and Tools.

File

The File menu has commands for letting you save your document, printing it out, opening another

document, starting a new document, and quitting when you are done.

Edit

In Edit, the main features are Undo, which enables you to cancel your changes or even the whole picture; Copy, that allows you to make a copy of a certain selection from different places and Clip Art in the computer; and Paste, that allows you to take that copy and put it into your document.

Goodies

This menu option gives many special features like zooming in and out to different amounts, and a list of shortcuts. Brush mirrors allows you to make kaleidoscope type pictures with different patterns.

Font

The Font menu and Style go together. Font is a list of fancy styles of writing and style is the choice for style and font, for example, Bold.

Patterns

When drawing in MacPaint, the Patterns menu gives you a choice between 38 different patterns for coloring. You can use these with the spray can, the paint bucket, and shapes like rectangles and circles.

Tools

The Tools menu contains tools that enable you to draw lines and shapes, erase and color with patterns, draw ovals, squares and circles. The Tools menu can be pulled off from the menu bar and you can keep it on your screen while you are working. This is really good because it saves a lot of time.

Drawing using MacPaint

Claudia went to MacPaint. First she went to the Tools menu and chose the pencil icon. She dragged the Tools menu off to save the hassle of pulling it down every time. She made a mistake, and used the eraser to delete it. She wanted more detail, so she zoomed in to 400% and drew a face that she liked. She added hair, and used the paint brush at 400% for the bigger areas. For the finer details she used the pencil. She checked regularly at actual size (100%) to make sure that she liked what she was doing.

Figure 1: Claudia's MacPaint Drawing

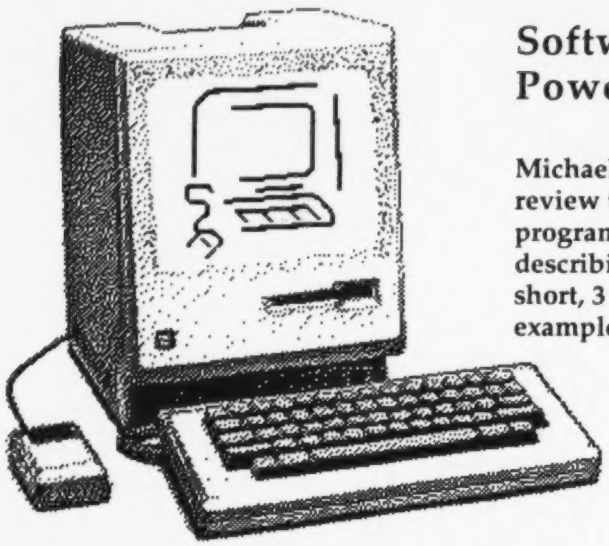
She drew the mouth with the paint brush because she wanted it thick and dark. For the rest of the body she used the spray can, but when she went back to the actual size she found that she didn't like it, so she tried Undo but that didn't work becuase she had kept on clicking the mouse instead of just holding it down. I think it's important to include that fact that not all things work the first time around and the eraser gets used alot! She changed to the paint brush for the top part of the body, and went through trying different patterns seeing which one she wanted. When she found the one she wanted she went to paintcan in Tools, clicked on the spot where she wanted the pattern, and colored it in. She used a number of different patterns for the shirt. She zoomed in at 200% to again add some more detail, then would go back to actual size to see if she was happy. She drew the hands and printed the picture.

Likes and Dislikes

We liked all of the tools you can draw with. The brush shape and brush mirrors were also good because they created an abstract pattern on the page. We liked the fact that there is practically no limit as to what you can draw. The zooming feature was also very good because they enable you to get closer to your picture and add details a lot easier than always working at full size. The patterns helped us alot, there are so many to choose from, so instead of using the pencil to color you simply go to patterns and have over 30 different ones to choose from. We also liked the different types of sizes, fonts and styles that you could use to make your writing really look good. Also, we liked the extra big size of print that we could not get in PowerPoint or HyperCard and we found that we would often go back to MacPaint to get the big print.

We thought it was really inconvenient to have to save every time you made something new, whereas in the program we are using now, HyperCard, it saves automatically for you. But basically we really liked using MacPaint. It was very easy to use and a lot of fun, even if you couldn't draw very well. We recommend this program as a good way to learn how to use the Macintosh computer and how to learn how to draw on the computer.

Reviewed by: Chantel Sawchuk and Claudia Azucena



Software Review: PowerPoint

Michael Fernuk and Jason Marien review the slide-show application program, PowerPoint. In addition to describing the program, they created a short, 3 slide production to use as an example of the development process.

PowerPoint is a Macintosh program which allows you to put together a slide show. On the screen there are eight pull-down menus. The first one is File. Under the File menu, there are all the options that you would use to save and open your work as well as paste clip art to the slide. The second is Edit. Under Edit there are the options that affect your picture or your work that you have on one of your slides, such as Undo anything you just did, Copy and Paste something from one slide to another, and to Open a new slide. The third menu option is View. Under View, there are options that allow you to change the size of your slide. There are also options to change the order of your slides and titles and also allows you to see how many slides you have done. The next menu option is Style. Under the Style menu there are options which allow you to touch up your writing through changing the size, font, and style. The next is Text. Under Text, the options are all about the text box. The sixth menu is Draw, and here there are options that effect what you are drawing. The next is Color, but we never used it because we only had Classics and they have black and white screens. The last menu is Window, and this allows you to flip between slide presentations without closing or opening.

Now we would like to describe the screen. We will start describing it on the left with the tools. The first tool you see is the Arrow tool. This tool enables you to put a frame around the picture or text you have on the screen. When the frame is around your picture or text, it allows you to move or stretch your picture larger or wider. The next tool is the straight line tool, which allows you to make straight lines sideways, up and down, and diagonal. After that is the circle tool which enables you to draw perfect circles and ovals of any size. The next tool is a rectangular shape but it has rounded edges. You can draw rectangles with rounded edges of any

size or shape. The next tool after that is a square shape that lets you draw squares, rectangles and diamonds if you turn it on it's side.

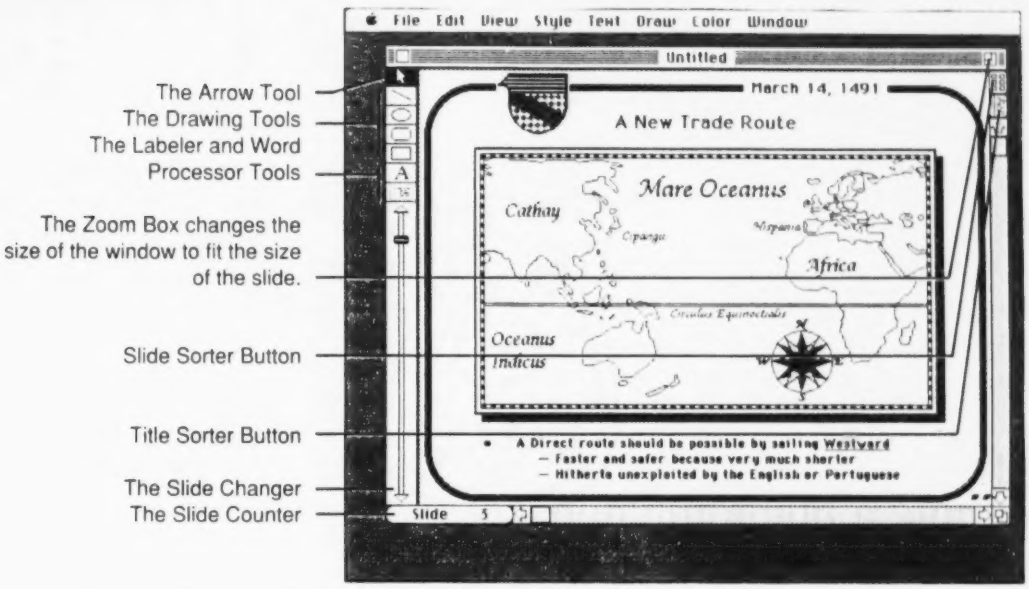

The Arrow Tool
The Drawing Tools
The Labeler and Word Processor Tools
The Zoom Box changes the size of the window to fit the size of the slide.
Slide Sorter Button
Title Sorter Button
The Slide Changer
The Slide Counter
File Edit View Style Text Draw Color Window
Untitled
March 14, 1491
A New Trade Route
Mare Oceanus
Cathay
Africa
Oceanus Indicus
A Direct route should be possible by sailing Westward
— Faster and safer because very much shorter
— Hitherto unexploited by the English or Portuguese
Slide 5

Figure 1: PowerPoint screen display

The text tool lets you write words of any size, style or font. Then there is the text box tool which allows you to just keep writing and you never have to press return because it's like a word processor and you can easily insert or delete and edit. Just below the tools is the slide changer which allows you to move from one slide to another by simply sliding it up and down using the mouse. Under the slide changer is the slide counter which shows you what slide you are working on. Next to that on the bottom is the elevator which allows you to move from side to side. On the right hand side of the screen is the slide sorter which lets you change the order that your slides appear in. You do this just by clicking on a slide and dragging it to where you want it to go. Below the slide sorter is the title sorter and then there is the up and down elevator.

Composing in PowerPoint

For this slideshow which we created in PowerPoint, first we went to MacPaint and drew a picture of a man jumping. We did this with the pencil and eraser tools. We worked at 50% (Editor's Note: magnification of the image on the screen, in other words, half the size of the actual image if printed on paper), but we zoomed in and out. When zoomed in, we used the elevator to move around. We used the black pattern with the paint can tool to fill in the man's mouth. Then we pulled down File and saved the picture of the jumping man. Then we went into PowerPoint.

The first thing we did in PowerPoint was press the delete key to erase the title which appears on every slide. Next, we pulled down File and highlighted PasteFrom. This enabled us to bring our jumping man picture onto the PowerPoint screen. Then we highlighted PasteFrom again. We went to Clip Art 1 (Editor's Note: A reference to a series of EPS shareware graphics) and chose a graphic from the Party folder. We adjusted the size and shape of the graphic by putting the arrow on the corner box and moving it. We then pulled down Edit and made a new slide. We clicked on the text box icon and made a text box. We went to the style menu and chose a font and a size. We changed it for the other words. We highlighted PasteFrom again and chose another graphic from Clip Art 1. We pasted this in. Then we made a new slide. We typed the words again, this time without a text box. To do this without a text box we clicked on the A tool from the menu on the side of the screen, and chose a place and clicked and started typing. After that, we got another graphic from Clip Art 3, a present. After we had adjusted the shape of the present we were finished. Then we pulled down File and highlighted SlideShow. We clicked on the Okay button and watched our slideshow.

Likes and Dislikes

We didn't like that there was hardly any drawing tools, so you had to draw in MacPaint and transfer it to PowerPoint. We also didn't like that when using Clip Art, it only says what the pictures are and doesn't show the picture itself. We liked how you could erase an entire picture just by clicking on it and pressing delete instead of having to use an eraser to erase it all. On the other hand, this was not good if you wanted to erase small parts. We liked how you could distort things easily by moving the corners of the boxes. We liked the Undo option after you made a mistake. We liked the text box function so that you could keep writing and not have to worry about pressing return at the end of each line. Also, it was easy to correct your typing mistakes and change the style and size of print. We liked that you could save all of your slides under one filename whereas in MacPaint you had to save every picture under individual file names.

We would recommend this program for all kids because it is a lot of fun to use, it was easy, and we really liked making slide shows on the computer. This was a great way to write about things and describe them.

Reviewed by: Michael Fernuk
and Jason Marien

In our next issue: Hypermediam!

Our next issue of ***The medium*** will be devoted to describing the nature of HyperCard, a computer-based, multimedia authoring environment. Specific articles will include:

HyperCard and multimedia authoring environments: The nature of the medium

This article will describe HyperCard, what is it, how it works, and why it offers tremendous potential as a context for multimedia, computer-based authoring.

Issues in Multimedia Authoring: Revisiting the authoring cycle

Based on a presentation made by the author at the International Reading Association's annual conference held in Edmonton, Alberta this past April, this article describes the authoring cycle from the perspective of computer-based, multimedia authoring environments. Specific examples will be included from the work of grade 8 students at Bishop Pocock Elementary School in Saskatoon, Saskatchewan, using the applications PowerPoint and HyperCard.

Authoring in HyperCard: The Post-Secondary Experience

Based on the responses and reflections of students in an educational media class at the University of Saskatchewan, this article describes the experiences of adult educators and post-secondary students using HyperCard.

Bishop Pocock's Multimedia Encyclopedia of Countries of the World!

As part of a research project undertaken by the grade 8 class, HyperCard was used as the medium to articulate the knowledge and information which students had gained of countries around the world. The research project is described, examples of the stacks composed by the students are provided, and a discussion of the possibilities of using an interactive knowledge base for community use is included.

Software Review: HyperCard

As part of our continuing series of assessments of the software used in the research project, two students will once again provide their analysis of Apple computers, HyperCard 2.0.

"The lab" as context

There is a qualitatively different experience for the teachers and students while teaching and learning in "the lab". This article will discuss the nature of the medium that is "the lab", the attributes of that medium, the qualities of teaching and learning, and the roles of the teacher and learners who dwell there, both from the perspective of the teacher, and from that of the grade 8 students from Bishop Pocock School.

Reflections on the authoring process: Converting linear print to hypertext

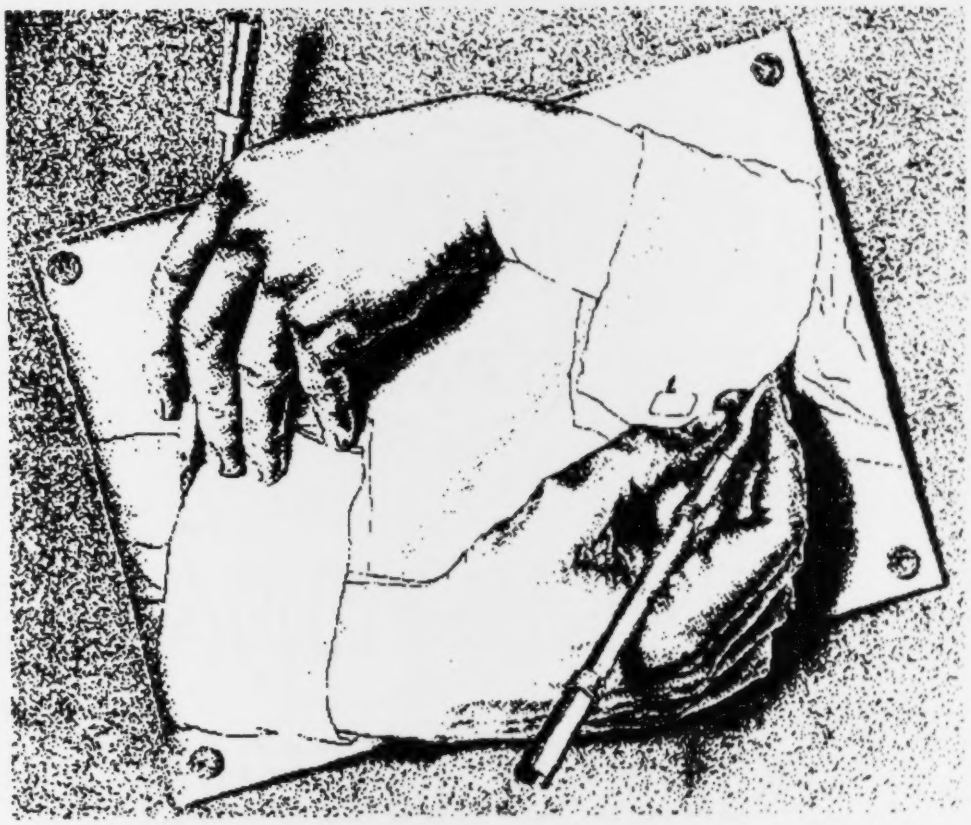
In addition to the articles written on the subject of HyperCard, hypertext and hypermedia, the next issue will also feature a diskette which will contain a HyperCard stack using the same information but written in hypertext. This article will be a companion to that stack, reflecting on the process by which the linear format of the article was "transformed" into a hypermedia composition.

Concept Mapping: The construction and description of meaning

Concept mapping, or webbing as it is sometimes known, has particular relevance to any discussion of authoring, and in particular, "hyper"authoring. This article will discuss a concept mapping exercise which evolved from introductory work in describing and explaining the notion of hypertext, and in particular, the students concept maps of HyperCard.

The medium

An inquiry into the nature of the authoring experience in a computing medium



Interested persons may support the production and publication of this journal in one of three ways: Benefactors provide a once only gift of $200 U.S., for which they receive a life membership and my eternal thanks and gratitude; Patrons provide a once only gift of $100 U.S., for which they receive an annual membership and my thanks and gratitude; Sponsors, provide a once only gift of $50 U.S., for which they receive my thanks!

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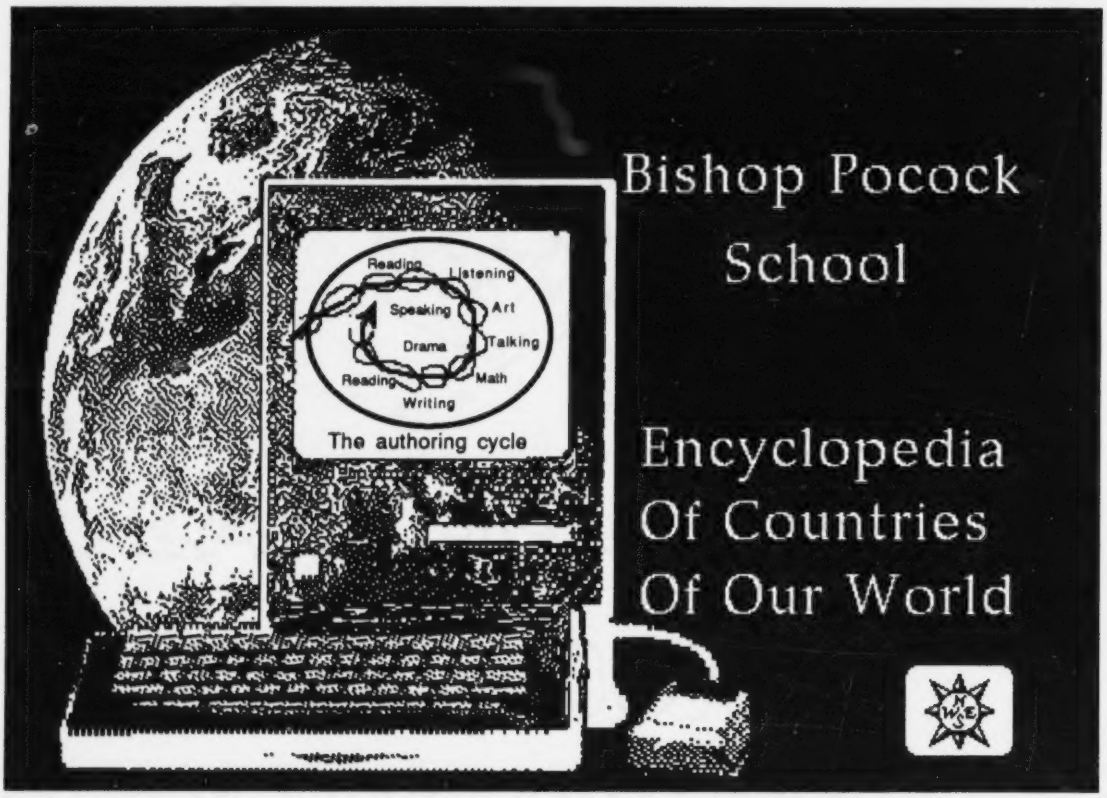

In this issue: ***Understanding hypermedia***

July, 1992 Volume 2, Number 2

The medium

An inquiry into the nature of the authoring experience in a computing medium

July, 1992 Volume 2, Number 2

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The aim of *The Medium* is to provide a forum for discussion and debate concerning the nature of the authoring experience in a computing medium. It is the contention of the author that computer-based, multimedia authoring environments constitute a qualitatively different experience as an authoring medium. It is to the description and interpretation of the nature of this authoring experience that this journal, as an on-going narrative of research conducted as partial fulfillment for the degree of Doctor of philosophy, is dedicated.

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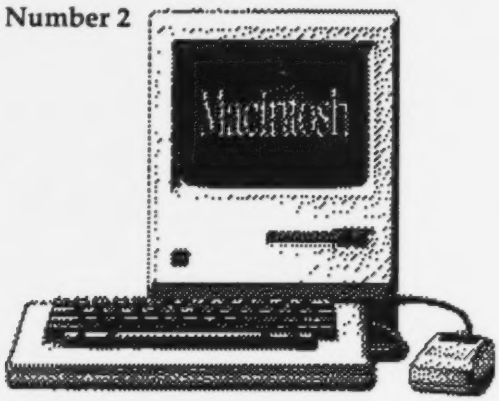
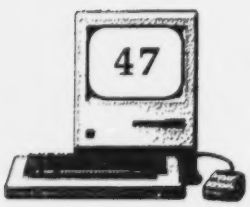
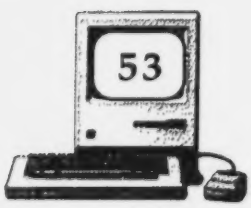




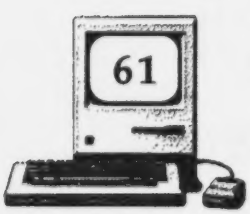
Welcome to "The Lab": Bringing a camel to life!

Reflections on the nature of what one student described as "a very, very special place to be".



Understanding hypermedia

Hypermedia, or interactive multimedia, is serving to re-define our notions about the role of computing technology in education. This article will describe hypermedia, it's elements and attributes, and discuss the implications for education.



Converting linear print to hypertext: A narrative

Hypertext must be experienced to be understood. This article will describe the authoring process, issues and challenges of converting a linear text to a hypertext.

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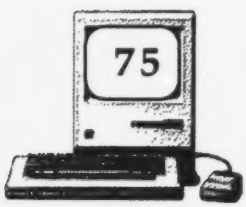
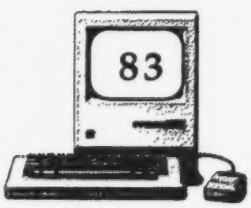


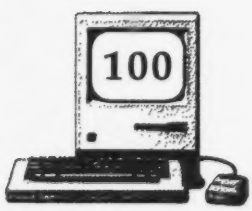
Teacher as learner as researcher: A dialogue

At any point in the research process, Stephen Kemp was at one and the same time a teacher, a learner, and a researcher. In conversation with *The medium* , Mr. Kemp discusses this approach to naturalistic inquiry.



Concept mapping and HyperCard: The construction and articulation of meaning

This article will describe the concept mapping approach, illustrate the applicability of concept mapping to the introduction, design and development of hypermedia for elementary school students, and conclude with a description of a computer-based, interactive, multimedia research project.



Concept maps: A recursive revision

Elaborating on the concept mapping approach for the construction and negotiation of meaning, this article features iconic representations and group discussions of the meaning of HyperCard for Grade 8 students at Bishop Pocock Elementary School.

The medium

An inquiry into the nature of the authoring experience in a computing medium

July, 1992 Volume 2, Number 2

In our next issue:

The ecology of hypermedia: Spinning the web of meaning

Issues in hypermedia authoring: Understanding the process

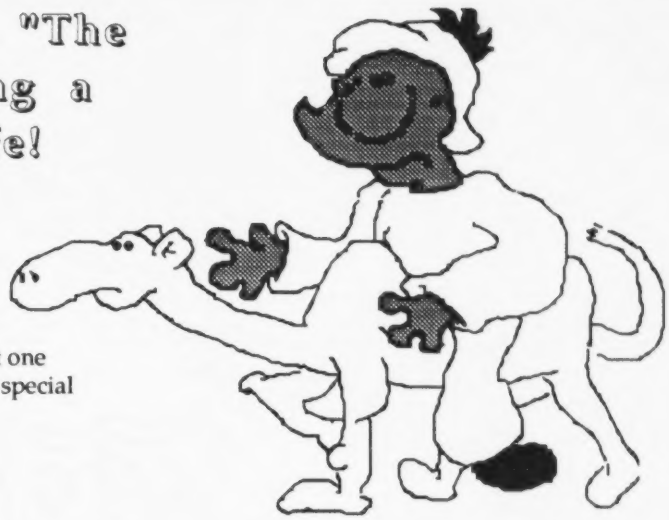
Author as publisher as editor: A dialogue

Student compositions in the medium of HyperCard

Software Reviews: HyperCard

MacRecorder

Welcome to "The lab": Bringing a camel to life!



Abstract: Reflections on what one student called " a very, very special place to be".

As I approached the lab it was obvious that the normal chit-chat and giggling that described the working atmosphere of the lab had given way to something far more boisterous. I paused outside the open door, out of sight of the students, to listen to the proceedings. Jared had somehow managed to attract the interest and involvement of the entire group, a mixture of the three groups who normally would have remained together but because of the fact that some students had finished their projects was a conglomeration of gender, talents and interests in hypermedia authoring. At first I couldn't make out the point of the discussion, but slowly the raison d'etre became more clear, at least on the surface: they were discussing what noises a camel made!

Several of the group were convinced that because it "sort of looked like a horse" that it was a neighing sound, but "because of it's big lips perhaps more of a vibrating, gurgling sound"! Someone with a distorted sense of humor noted that because it was called a "Ship of the desert" that "perhaps it made a sound like a fog horn"! General laughter and assorted libelous comments followed, and even I was forced to admit that at least it was an interesting possibility. "Cows, they moo like cows, I mean just look at them, they're as ugly as cows". Well at least the possibilities had returned to the animal kingdom! The excitement and energy, the attachment and engagement to the task was fascinating, and energizing. From amidst all of the possible comments offered by the group came a suggestion of unique insight and intelligence: to consult an encyclopedia! After a brief pause in which this obviously perceptive comment was being generally considered, several of the students rushed hurriedly out of the lab into the library to be the one to come up with the one, right answer. I waited patiently outside, listening.

After what seemed like an unusually short time for these students to find out an answer to any question that either I or they had posed, they returned in defeat. "It doesn't say anything about what noises they make", Norbert offered,

"but I didn't know that their humps are made up of fat which they use to store water. That's why they can go for so long without drinking, Neat, huh?" Faced with a situation which seemingly had no resolution, they were at an apparent standstill. An eerie calm descended over the lab!

Just then, a "far-from-equilibrium" event occurred in the person of Sam Hormis, a student of Iraqi descent. Sam had been working in the classroom, but having finished his art project, was coming to the lab to see if there was a free computer. I motioned to Sam not to acknowledge that I was outside the lab, and so he went on in completely unaware that he was to be that one event that would drive the system out of it's current state and upwards and onto a new, more complete unity. Sam was walking into a dissipative structure!

Sam entered the lab to an uneasy, disconcerted audience. It had somehow become very important to them, and particularly to Jared, to try to duplicate a camel sound using MacRecorder so that the sound could be included in his hypertext, multimedia project of an encyclopedia of countries of the world. Jared had chosen Saudi Arabia. The fact that even an encyclopedia, and several types as well, did not have the definitive answer had left them in a quandry. Sam strolled in, and innocently asked what was going on. When answered, he immediately supplied the answer, along with a brief comment to the effect that they were dirty, smelly, disgusting things. The equilibrium destroyed, the room broke into gales of laughter. "Hurumphh? Cool, that was really cool." "Awesome, I knew it was going to be something like that". But now another problem arose. Who would be the voice behind the camel? Now the system had risen to new levels of collaboration, insight and cooperation. "Let's audition!" I couldn't believe my ears, they wanted to audition for the role of a camel in a HyperCard stack! Adolescents never fail to surprise or amaze me.

I will spare you the details of the audition process, suffice to say that it attracted the notice of the secretary down the hall, two parent volunteers working in the library, and of course the grade twos on the way to the gym with their teacher (who cast me a sympathetic glance as she went by as if to say, Don't worry, hang on, they'll be in grade nine soon!). Again, no definitive answer. Faced with several excellent choices, it was decided upon by Jared that a group effort would be perfect. He readied the MacRecorder microphone, had several quick rehearsals, and nailed it on the first take! The replay was greeted by excited applause and laughter and finally everyone seemed to agree, including Sam, that that was as close to the real thing as could ever be expected. A few moments of quiet passed while Jared was presumably copying the sound into his production. Finally, the anticipatory silence was broken. "Okay, listen.....Hurumphh..... Yes!"

At this point I was tempted to go into the lab, but I quietly turned around and went back to the classroom. In listening, I had learned a great deal about the nature of hypermedia, collaboration, meaning-making, self-directed learning, the roles of teachers, learners and technology, and the attributes of the authoring process in a computer-based, multimodal context.

The lab as context

Technically, "the lab" is a rectangular room measuring approximately 4 meters by 9 meters. It is adjacent to the front entrance of Bishop Pocock Elementary School, bounded on one side by the front hallway, and on the other by the school library. Doors connect the lab both to the hallway and into the library. A series of square windows separate the lab from the library, making it appear more wide open and spacious than it really is. The predominant colors are white, grey and salmon. The room is illuminated by a row of double fluorescent lights, but the majority of the time these lights are turned off by the students who prefer working in the dark. Countertops run along both sides of the lab, while erasable white boards occupy both ends. Technically, the lab is a small but cosy room, perhaps leaning more to the clinical side of aesthetics. In reality, however, the lab is a very, very special place to Be.

> I think everybody was quite relaxed working in that *special environment* . I remember one day, one group from our class was on the computers and we were working on our own HyperCard projects. Somebody had *asked* Mr. Kemp for a little bit of help, but after he was done *helping* them he just pulled up a chair and sat there and observed all of us working. He occasionally asked us *questions* about what we were doing, but mostly he just sat there and *listened.*
>
> The strange thing was nobody was nervous about our teacher being there watching us doing our work. There was no *pressure* , it was almost as if he *wasn't a teacher* anymore. Everybody really *enjoyed showing* him their stacks, and *asking* for his comments. Although he was there, it wasn't dead silent working, there was a lot of *chit-chatting* going on, but still our *work* was being done too. Friends were also *showing* each other things and new *ways* of using the computer and they were also *sharing* ideas and *building* off of them. To me, the lab was a very, very special place to be. (Tyler)

It wasn't what you might ordinarily expect a lab to be, particularly as most of our experiences are in a scientific domain where labs were the places to conduct experiments and test hypotheses; places for deducing, verifying and concluding; places where the object of the exercise was to find the one, right answer. In that context, this was most certainly not a "lab". This was an environment for activity that was emergent, indeterminate, irreducible and unpredictable. It involved an on-going process of sharing and learning and teaching and listening and creating and talking. It had all of the qualities of an educational environment that intuition and common sense (and literature) tell us is the kind of open, dynamic medium that will promote growth and understanding.

> To me, the lab was a place where you could leave school with your friends, and go to a place where you were free to use your imagination, talk to your friends about all kinds of neat stuff, and listen to their ideas. The lab wasn't like school, even though it was in a school, because when we were in the lab everybody was sort of on the same level, there wasn't a teacher talking and everybody listening and being told what to do. In the lab we were all equal, even though Mr. Kemp knew the most, but he never told us what to do, he just was there to help us and maybe sometimes he would give us ideas about

> what he thought we could do. Sometimes he was just there and we didn't even notice because we were all talking and working and so we kind of forgot about him being the teacher. It was sort of like we were all the teacher and we were all the learners too, even Mr. Kemp. (Jared)

> I liked working in the computer lab because I could work in private, but also share ideas and stuff with other people. It was sort of like the best of two worlds. I liked the attitude everyone had while working in the lab. Everyone helped each other and shared ideas. (Claudia)

Talk, dialogue, discourse. This is an aspect of the authoring cycle (Harste, Short, & Burke, 1988) that is perhaps not emphasized enough. So much of writing process theory emphasizes blocks of quiet, secluded time where one can find time and space to let the thoughts bubble up to the surface. But this was not the case in the lab, far from it. The lab was never quiet, it was full of conversation both "on- and off-task". My point is that perhaps it was all "on-task", even though to an observer it might have appeared as John describes it, "idle chit-chat". It was a forum for ideas, possibilities, opportunities.

> There are always many thoughts and ideas floating around the room. You hear these thoughts and sometimes you may change it slightly and use it, or it may give you a totally different idea. For example, one day I was talking to Mike about soccer, and then it gave me an idea about a boat. I don't know how I got this out of what we were talking about, but his seems to happen lots of times, and not just to me. All the other guys have said how these ideas just pop up from out of nowhere. (Jason)

> The room itself is never silent, but the seven other students in my group (Group 1) are constantly discussing their projects, asking each other for help or ideas, or just talking about things that have nothing to do with what we're working on. This "idle chit-chat" is known to trigger many ideas inside my head that may appear in my finished product. For example in Career Opportunities (my last HyperCard project) I have an electrocution animation sequence. The idea for this came from when we were talking about what had happened on a t.v. show the night before. Our computer lab is different from the classroom not only because it has computers, but also because of it's atmosphere. Everyone talks and shares and works, and even Mr. Kemp just likes to come in and visit. He always helps us when we ask, but lots of times he just comes in and sits and watches and listens, but we keep talking anyway. (John)

John's description raised an interesting point about my role in the process. I had not articulated my perspective and approach as to how I wanted to conduct myself in the variety of roles that I had assumed: researcher, teacher, and learner. Interestingly, however, my quiet, attentive approach to all of these had not gone unnoticed by the students. Many times it was noted by them in their journal entries. John's comment from above was, "lots of times he just comes in and sits and watches and *listens* ", while Tyler's was that "he occasionally asked us questions about what we were doing, but mostly he

just sat there and *listened* ". I always tried to make myself available when necessary, for help or advice or comments on any aspect of their projects. But I rarely, if ever, initiated the dialogue, preferring instead to allow the students to begin. There were many, many times when I literally just stood or sat and watched and listened! At first this was disconcerting for me, because I was used to the more traditional paradigm of teacher-initiated, teacher-directed projects where I was in a management mode and controlled and prescribed the entire process. But in the lab, I approached every opportunity with an attitude of collaboration, of patience, of sensitivity, and of just letting things happen. It was an attitude of being open to surprise, and the surprise I got was continual amazement at the depth and scope of learning and exploring that self-motivated, self-referential, self-maintaining learners could create. Not only did this approach create an unprecedented (in my teaching experience) degree of attachment and engagement to the task, but it allowed the students to grow and assume all of the different aspects in an educational environment:

> There are many different people who go into the lab. There are teachers, learners, observers and helpers. This year I have been all of these things, sometimes even in the same period. Even our teacher, Mr. Kemp was all of these things. The teachers are there to teach you about things you don't know. They teach you how to work different options and things you're not sure of. The learners are working on their projects, learning more and more from the teachers, the other learners, observers and helpers. Then there are the observers and the helpers who just sort of wander around sometimes helping out and giving advice or just watching people work. (Ryan)

Daiyo Sawada and Michael Caley (1985) describe a new metaphor for education, Dissipative Structures: New structures for becoming in education. In the article, they discuss the concept of Being and Becoming as entities which can emerge from contexts that on the outside might be viewed as loud, noisy, and disruptive. Well, in that sense, the lab was certainly at times "far-from-equilibrium"! There was lots of noise, lots of confusion, lots of activity and dynamism. But from that context emerged the products that I will be sharing with you both in this issue of *The medium*, and in the next one as well. In that sense, then, I will let the products speak for themselves.

> In my group, we visit, discuss our projects and other happenings at school while we're getting something done. I always seemed to get a lot done in the lab, even though we were always talking. They also helped a lot when I needed help with something I was stuck on, and their opinion on my doings. Even when Mr. Kemp wasn't in the lab we didn't fool around and act crazy, we did our work. We didn't want to let him down, or ourselves too. (Chantel)

> When I'm working in the library and I look into the computer lab, I always see people smiling and laughing and then that makes me want to go in there. So I tell Mr. Kemp I have to go in there for some reason, and he always buys it, [Editor's note: this point is reasonable grounds for severe disciplinary action!!!] so I go in there and see what the other people are doing, and then I

> get ideas to use on my computer. If someone were to come in there and just sit and listen, they would probably find it quite amazing to listen what people talk about, yet still get their work done. When I'm in the lab I'm never bored. I think it's because of the happy people enjoying what they're doing. (Amy)

> To me the lab was a fun place because usually only my friends and I were in there. This gave us a chance to work on the computers as well as talk freely about whatever we wanted. I don't think in the lab, when you talked with other people, that it stopped your working or even slowed you down any. Having my friends there gave me lots of good ideas, and made it a fun place to be. (Michael)

Our lab had all of the attributes of a medium of growth. There were no arbitrary, externally imposed standards of performance. This was a medium that evolved from within, a context that was emergent and evolutionary, fueled by the dynamism of the students, directed by their collaboration. In the same sense that a cell is a complete living entity, perfectly coupled within it's larger context, so too our lab was cell-like.

It's outer wall was not a barrier, it was a membrane. Through that membrane passed the nutrients and elements to sustain it's growth and development; the students and myself. There was a constant exchange between the lab and it's outer environment. Other people, other ideas, other possibilities constantly impinged on the lab, and it adapted and changed.

Once inside, the synergy of collaboration, the sharing and exchange of ideas and possibilities fueled the evolution of the organism. There was not a single incidence of violent disagreement or dispute. There was not one instance of judgement or evaluation. There was only the dynamism of active participation, each student adding to the growth of the lab by adding to the growth of each other. There was no such thing as possession, only possibility.

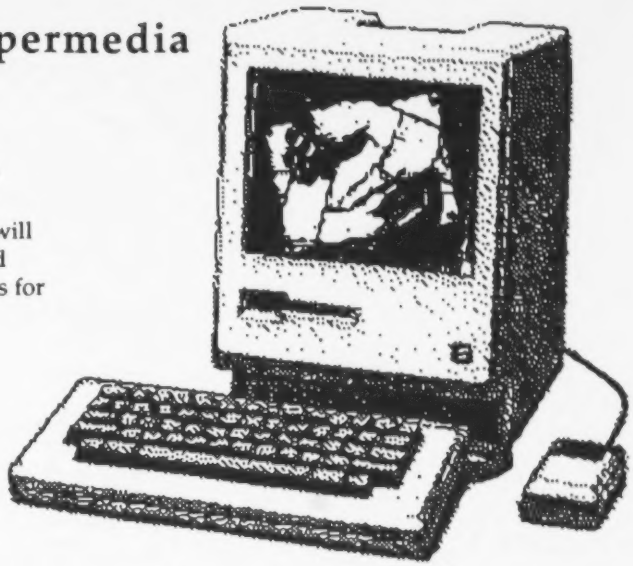
I began this article talking about the lab as being, in Tyler's words, "a very, very special place to Be". Notice the capitalized term. I did this to emphasize what I think the lab as context means for me: it was a place for the Self, a place to grow in Self-awareness and Self-confidence. It was a place where students could write the stories of themselves, an unfolding narrative of Being and Becoming. It was a dynamic, open, nurturing medium, a context for the whole person.

Gary Zukav (1982), in searching for a means to describe the essential nature of the relationship between matter and form at the sub-atomic level, employed the metaphor of a dance. Similarly, the same question that he asked of the nature of nature can be posed of the relationship between the students and myself and the lab, between our knowing and being, between our being and becoming:

How can you know the dancer from the dance?

Understanding hypermedia

Abstract: Hypermedia, or interactive multimedia, is serving to re-define our notions about the role of computing technology in education. This article will describe hypermedia, it's elements and attributes, and discuss the implications for education.



Only a few years ago, artificial intelligence was being heralded as the next, and possibly the last or ultimate "generation" of computer technology. But the incredible complexity inherent in replicating or simulating the human mind has reduced the anticipated impact of artificial intelligence techniques to a by-line of what could now be termed the new, emerging generation, "interactive multimedia, or hypermedia" (Kinzie & Berdel, 1991, p. 61).

Interactive multimedia has two aspects: Multimedia represents the integration of a variety of media, including print, graphics, sound, animation and video; Interactivity comes from the development of an authoring environment such as Apple Computer's HyperCard, which facilitates the creation of non-linear, multi - dimensional, activity - based environments which utilize those media. The result is a "metamedium". (Bailey, 1990, p. 3)

The issue before us is the nature of this "metamedium", in terms of its elements and attributes, and discuss the potential for realization in the context that is education.

The elements: text / media

Recent developments in the integration of video signals in combination with computer generated graphics, sound and animation, are continually re-defining our notions of multimedia. Information representation, storage and presentation is improving at an exponential rate, so much so that the era of laptop, multimedia computers with instant access to thousands of databases all of which contain millions of references to millions of topics and articles is on the horizon. Technical attributes such as "rapid access to vast amounts of information in a variety of formats" (Marchionini, 1988, p. 8) are a given, and we can only anticipate that

the current rate of improvement will quicken. These variety of formats are classified as "multimedia", but there are two aspects to this unity: hypertext and hypermedia.

Hypertext

Hypertext has been variously described as "nonlinear" or "nonsequential" or "multi-dimensional" writing (Davis, 1989a). It is the process by which a composition is created, but in contrast to the paper medium in which the organization and presentation of the material is two-dimensional and linear, the process in Hypertext involves the construction of "nodes" of information which are "linked" together in three dimensions. The closest analogy is perhaps the "choose your own adventure" type novels, in which the reader is presented with a series of choices at certain critical points in the story, and has in that sense, therefore, control over the story's development and ultimately it's conclusion. The nodes in this case would be the page(s) of information, while the links would be represented by the choices presented. Similarly, researching material through a series of indexes which link information together by a series of attributes is also akin to the process of "reading" hypertext. In this case, the nodes would be the particular articles or pictures which are referenced, while the reference citation would be the link. In both cases, there is the implicit assumption that the whole process, while non-sequential in that it does not necessarily follow a similar pattern for each reader, is nonetheless coherent and complete, in other words, there is an underlying unity to the process.

Switching our focus to the writing, or authoring aspect of hypertext, the task now becomes one of designing screens of information (each screen representing one node, or "Card") using the media available, most notably text and graphics.

> A node is by definition a knot, a complication, an entanglement - in short, a node is always embedded in a system, and the whole system must be taken into account. A node is something through which other things must pass, and which is created by their passage. (Carlson, 1988, p. 126)

Thus a structure emerges, for the prime consideration at this point is the organization and representation of the knowledge. Jonassen (1988) has described several types of hypertext structures, but as Bulick (1990) writes, "most existing models have used an 'object-oriented' scheme with an aggregation hierarchy in which each object is an abstraction of all the objects below it" (p. 94). Therefore, the user of a hypertext interested in a particular muscle of the human body might progress from the most abstract descriptor, biotic, to animal to mammal to human to anatomy to muscles to skeletal muscle to the deltoids. Each of these objects would represent one node of information.

The links between the nodes, or cards, represent both the explicit and implicit assumptions that the author has made regarding the structure of the knowledge presented and the relationships between it's discrete elements. These links are often referred to as "buttons", for small icons are created which act as the

physical representation of the links between the cards. Activating a button will initiate the link between the cards, linkages which are author-determined. But the critical importance of the links cannot be understated, for as Carlson (1988) states in metaphorically describing hypertext as poetry, "those associations are not extrinsic, not nonessential: they ***constitute*** the poem" (p. 116). Extending the analogy in which "cards" are assembled and organized, the final product is referred to as a "Stack".

Hypermedia

Hypermedia is not a single technology, but a mixture of technologies (which can include information from any number of video and audio sources), controlled by hypertext (Blanchard & Rottenburg, 1990, p. 657). In hypermedia authoring, technological advances allow for the incorporation of text, graphics, sound, animation and video into discrete nodes of information which are then linked together based on certain criteria for relationship.

In the medium of HyperCard 2.0, a commercially produced authoring environment from Apple Computer Inc., graphics may be created from within the program itself by the means of various painting tools very similar to those available in other art programs such as MacPaint, MacDraw and SuperPaint. In addition, graphics may also be incorporated from collections of commercially prepared graphics known as Clip Art, and then edited using the graphics capabilities of HyperCard. Sound is available through a number of different applications such as HyperMacintalk, which emulates human speech through a phonetically-based approach, or MacRecorder, which digitizes sound and provides for sound creation and editing functions. These sounds can then be incorporated directly into the HyperCard compositions. Animation is possible within HyperCard by creating a series of nodes which differ slightly in the presentation of the graphics, thus replicating the crude animation created by rapidly flipping through a series of cards. Other forms of information transfer include the integration of productions from other applications programs running under the "umbrella" of HyperCard, and the incorporation of video and scanned images.

The attributes: "hyper"

The term Hyper-, as a prefix, denotes the concepts of above, beyond, or surpassing. It is in this context, therefore, that the terms hypermedia and hypertext have been coined to exemplify an authoring environment in which the media and the text itself, can be transformed into something else, something that goes above and beyond our conceptualization of what technology, media, and the authoring process can do, represent, or can become.

Interactive multimedia authoring is the process of navigating to islands of articulation in a sea of expression. **Empowered** with this opportunity to literally "chart your own course", the author can express or articulate their knowing in

> an enabling rather than a directive environment. Hypermedia offers new opportunities to diverge from the linear path; to juxtapose text, animation and sound; to turn the technology back on

> itself as an aid in producing new interpretations of the content. (Marchionini, 1988, p. 9)

Slatin (1990), eloquently describes this dynamism, a recursive, evolutionary process that knows horizons, but no boundaries.

> One implication of this is that the hyperdocument "grows" by a process of accretion, whereas the conventional document tends to have been winnowed out of a larger mass of material. HyperCard is, therefore, an inclusive medium. The end product of the authoring process, the hyperdocument, is not a closed system, like a book; it is rather an **open and dynamic system**. (p. 876)

While not without it's problems and limitations, the concept of **personalization** is one that is fundamental to a hyper-environment. The old adage that more is not necessarily better certainly applies to the issue of the degree and type of learner control, but Jonassen (1988a) argues strongly in favor of individualizing the learning process, stating that

> In hypertext, readers are not constrained by the subject matter structure or by the author's organization of the text. Since an individual's knowledge structure is unique, based upon his or her own set of experiences and abilities, the ways that individuals prefer to access, interact with, and interrelate information is also distinct. (p. 14)

Perhaps synonymous with the term, "hyper-", the term, "**multi-**" is one that is often used to describe the attributes of such a learning and teaching environment. Multimedia, of course, relates to the variety of visual and auditory media that can be incorporated into a composition, and goes hand in hand with "multisensory", for a hyper-environment is often a steady barrage upon the senses. Similarly, multi-dimensional is often acknowledged as a critical attribute, particularly in comparison with the dual dimensionality of the paper medium.

> Print, like all types of media, has both strengths and weaknesses. Primarily, the weaknesses of print are its: (1) use of a single sensory channel (vision); (2) reliance on a fixed, linear sequence of presentation; (3) lack of interactivity; (4) absence of built -in editing tools to create new intellectual works; and (5) restriction to single-user mode only. It should be apparent that these weaknesses of print are the strengths of multimedia computer systems. Depending on its underlying technological infra-structure, a multimedia computer system can provide the user with a multisensory, nonlinear, highly interactive, edit-oriented, multiuser environment. (Bailey, 1990, p. 35)

Younggren (1988), also describes this multivariate process, the ability to "learn and access information that truly incorporates the idea of n-dimensions - the ability to move in any direction that seems appropriate at hand" (p. 78).

The tenor and tone of every article about hypermedia suggests activity, engagement, action and doing. It is very much a dynamic medium, but with the ever-present potential of being lost in a limitless expanse of information, unable to move ahead and not knowing where and why you arrived at your present

place, the need for a sense of **coherence** is paramount. Hypertext walks a thin line between order and chaos, for on the one hand it promises to bring greater clarity and a unified vision over bodies of information, yet at the same time, it contains the possibilities of further fractionalizing knowledge (Byles, 1988, p. 60). The task then becomes one of creating, or maintaining a coherent whole.

> Hypertext and hypermedia systems are of such signal importance precisely because they permit us to assemble large collections of discrete materials composed in different media, and to link them usefully and powerfully together in a variety of ways, without destroying the integrity of the individual components, the nodes of the system. (Slatin, 1988, p. 127)

The attributes of this new context for creating are many and varied. From the perspective of the author, the medium of hypertext has been described as "empowering, enabling, open, dynamic, multifaceted, and personalized", offering the potential for articulation and expression in a medium that facilitates the construction of personal meaning-making.

The role of "Hyper" Environments

Byles (1988) has suggested two general categories into which he feels most applications of hypermedia can be classified: "referential", or that perspective on the role of technology which focuses in on the information-delivery aspect; and "inferential", in which meaning is personally constructed and implied, not prescribed or pre-determined (p. 62).

Referential: Authoring as instructional design

A referential perspective of technology as an informational delivery system, regards the role of hypermedia as a context in which can be designed and constructed powerful "learning environments". Such environments are described by Yazdani & Lawler (1986) as having the following characteristics:

> 1. Focused aim of providing "authentic knowledge"
> 2. Exploratory learning environment
> 3. Learner is active, conscious
> 4. Integration and assimilation of knowledge. (p. 199)

The power of such an environment, it is proposed, is in its ability to take the products of an environment, in this case text and graphics, and construct a learning environment in which the products now become tools of their own right. Thus we have the continual referencing to other nodes via linkages which have established the relationships between them. The nodes, both written and graphical, become increasingly iconic in nature, self-referential, able to be experienced in different forms (Jonassen, 1988a, p. 14). Selecting a particular term may lead to additional textual, graphical, animated or sound sequences to elaborate and extend the concept. Carlson (1991), describes the role of hypertext in the creation of inquiry based, knowledge databases.

> Instruction can be designed to involve the learner in an inquiry process in which facts are gathered from data sources, similarities and differences among facts are noted, and concepts are developed. In this process, the instructional program serve as a facilitator of learning for students who are working to develop their own answers to questions. (p. 41)

Jonassen (1988a), in describing Hyper environments as "facilitating knowledge exploration by the learner", extends the description of hypertext as a knowledge microworld to include the assessment and diagnosis of information gained and learned. Based on the premise of cognitive psychology that learning is a reorganization of cognitive structure, the role of hyper- environments would be as

> tools for assessing cognitive structure, tools for depicting and displaying appropriate knowledge structures, as well as means for mapping that structure onto the learner's knowledge structure. (p. 13)

From the perspective of instructional design and delivery, therefore, hypermedia authoring presents many challenges for instructors and instructional designers.

Inferential: Authoring as authorship

Approaching the technology from the perspective of a tool or an agency to facilitate change offers yet another avenue of opportunity. As Mary Huston (1990) writes, "authorship is potentially the most effective activity which hypermedia has to offer"(p. 337).

Anderson-Inman (1991) describes the constructivist perspective on meaning -making when he writes

> Using and developing HyperCard stacks makes an important contribution to student education because they make connections and look for commonalities in the content of what they're presenting. Similarly, planning a HyperCard stack is a way of making those connections. (p. 32)

Tsai (1989), in describing a Hypertext system as a "general tool for thought", also appears to be describing and defining what Byles has termed the "inferential" aspect of hypermedia.

> Knowledge workers such as writers, instructional designers, researchers, and other professionals can use hypertext systems to analyze, organize, integrate, and share information and knowledge. In a hypertext system, relation links help to reveal the structure of the issue, problem, or solution in question. Knowledge workers can reorganize the information space in different ways to aid in forming better conceptual models and finding better expressions of these models. (p. 8)

In this context, the "inferential" hypertext environment is distinct from that of a referential environment in that the learner can determine the goal, method or strategy, and the rules which govern the interaction. There is, in effect, no attempt to create a representation in a hypertext medium based on a set of pre-determined criteria, rather, the learner actively engages the raw information to create knowledge through personal interpretation based on individual experience.

Byles (1988) elaborates on this same perspective in describing hypertext as a

> linguistic medium, a technology that augments social discourse, and can be applied to many topics and domains of knowledge. Its applicability and design, however, are determined by the relationship between the topic or domain and the popular discourse on the topic to which it is directed. Hypertext that teaches is different from hypertext that proposes. (p. 61)

We are therefore left with a basic dialectic of views and perspectives as to the role and applications for hypermedia. While not suggesting that the multitude of initiatives in this area can be neatly categorized, there appears to be two, general approaches: from inquiry-based, referential, informational delivery systems that facilitate the individualized approach to learning; to that of a context, a medium in which dialogue, discourse and inferential learning may be promoted.

Summary

The term Hyper-, as a prefix, denotes the concepts of above, beyond, or surpassing. It is in this context, therefore, that the terms **hypermedia** and **hypertext** have been coined to exemplify an authoring environment in which the media and the text itself, can be transformed into something else, something that goes above and beyond our conceptualization of what technology, media, and the authoring process can do, represent, or can become.

Hypermedia is not a single technology, but a mixture of technologies (which can include information from any number of video and audio sources), controlled by **hypertext** (Blanchard & Rottenburg, 1990, p. 657). In hypermedia authoring, technological advances allow for the incorporation of **text, graphics, sound, animation** and **video** into discrete **nodes** of information which are then **linked** together based on certain criteria for relationship.

From the perspective of a both an author and reader of hypertext, hypermedia is an **empowering, personal, dynamic, open-ended, multi**-dimensional environment that allows for the personal construction of meaning.

Byles (1988) has suggested two general categories into which he feels most applications of hypermedia can be classified: "**referential**", or that perspective on the role of technology which focuses in on the information-delivery aspect; and "**inferential**", in which meaning is personally constructed and implied, not prescribed or pre-determined (p. 62).

The metaphor which perhaps most clearly describes the unity and inter-relatedness of hypermedia is that of "a web, in which anything that affects one strand of the web vibrates throughout the whole" (Cooper, 1986, p. 370). The ecology of hypermedia, therefore, is a continual process of creating connectedness, developing or maintaining inter-relationships by remaining coupled in, with, and through, the hypermediam.

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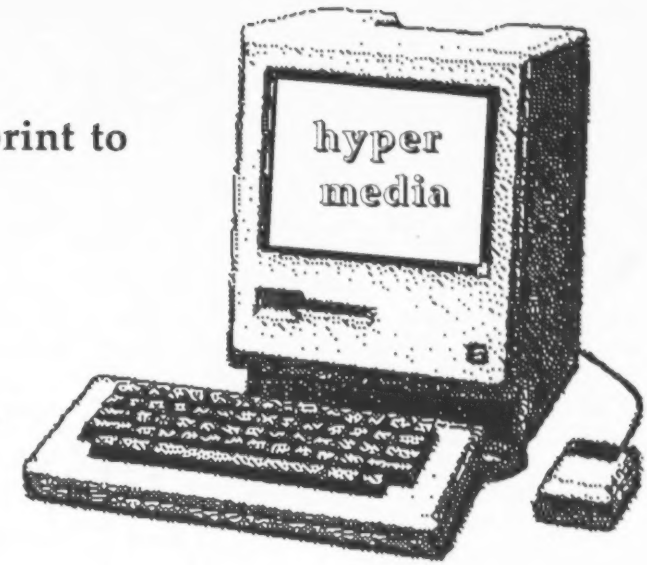
Converting linear print to

A narrative

Abstract: The authoring process in hypertext must be experienced to be fully understood. To gain an appreciation of the issues, processes and challenges of converting a linear text to a hypertext, the author narrates his experiences as they unfolded.



I had finished an extensive review of the literature concerning hypertext and hypermedia, and the attributes and qualities of this new authoring environment. But my own inclination was to believe that the key to understanding hypermedia authoring was to experience it Personally. To do is to understand. In that sense, then, coming to understand the process of composing hypertext was no different than any other. But while the approach to understanding was not unique, the actual process itself was. It was a fabulous journey, a complexing and frustrating process, yet at the same time, an engaging one. It was a process that once began could not be put aside. In terms of time, I worked on converting the Understanding hypermedia article which appears earlier in this issue of *The medium* for a total of 14 hours, in one single block of time, with only two short breaks for the necessities of life!

This article is a narrative of that experience. I had already written the article, Understanding hypermedia, and so had before me the printed text which I was going to convert to a multi-dimensional, multimedia composition using Apple Computer's HyperCard 2.0 on my Macintosh SE. I was reasonably well versed in the nature of hypermedia, and had spent countless hours working with my students in the production of our multimedia encyclopedia of countries of the world. I had also authored several short stacks on a variety of topics of personal interest to learn more about the program and to acquire a basic set of skills. But all of a sudden, all of that knowledge, all of that experience deserted me! I was paralyzed with indecision, I had absolutely no idea how to begin!

My thoughts were a random mixture of questions about structure, format, style of writing, and so on. I asked myself questions like, What is the central theme? What about using

the title as a core? What about the categories of information, should I use them? Maybe I'll make it a simulation, or what about an interactive narrative where the reader gets to choose? Outline, what about using the outline?

I called a halt to this seemingly endless process by deciding that I would focus in on the structure of the article. I went through the text, and made an outline of the basic topics and sub-topics:

Title: Understanding hypermedia

Abstract
Introduction
Elements:
- Introduction
- hypertext
- hypermedia
- summary

Attributes
- hyper
- attributes (5)

Role
- Byles' classification
- referential
- inferential
- summary

Summary
References

My thoughts turned back now towards the format for presentation. Could I use the abstract as a core, and then branch off of that out to the various topics? What about using a glossary of terms, or an index, or a menu of choices, and what about references? Perhaps I should use the summary in some way, and then branch off of that out to the topics, or even out to the words? Then it occurred to me that I had not addressed the most basic issue of all: Was this going to be a referential knowledge base, or was this going to be an inferential one? I thought back to what Byles had said: Hypertext that teaches is different from hypertext that proposes. This was the crux of the issue, to decide whether I was going to teach, or allow the reader free access to any aspect of the information, allowing them to roam at will and construct their own meaning.

I sat there for a long time, perhaps a half hour or more debating the merits of both approaches. In terms of the referential, I began to think of coaching strategies, help options, breaking the topic down into nodes, hierarchies and linkages and the reasons for them. As my thoughts drifted to the inferential, it occurred to me that that would be completely simple, make each node one specific point or paragraph, but then the questions of navigation, coherence, and purpose sprang up.

I went back to the structure, thinking of different ways that I could relate the basic topics, because perhaps in the relationships I could see a way to perhaps accommodate both approaches. I did not want this to be an either/or situation. My attitude towards all things is to seek a balance and a harmony, a dialectic as oppose to a dichotomy. I drew several outlines for organizing the material: one looked like a root system, with the introduction at the top, and then strands coming off of it, one for each of the three main topics, and then smaller branches off of each of those; another looked like 3 inter-nested loops, much like the paradigm I have been describing for the nature of the relationship between medium / message / meaning, with the abstract

as the medium, elements as the message, and role as the meaning; a third looked like a triangular web, with elements, attributes and roles as the strands, connected by thin lines and the core as the summary. For some reason this last effort appealed to me, especially as in reading the literature the metaphor of a web had been described for the ecology of authoring (of which this was obviously a part). I thought back about Jonassen's statement that the nature of the structure of a hypertext is a message (1988), and in that design I began to see the self -referentiality I was looking for. The metaphor of hypertext as a web was there in it's structure.

I thought of the make-up of that web. It had major strands, connected by thin strands in between. Were the basic topics the major strands or the connecting strands? If they were the major strands, what joined them together, the words? I thought about the process of spinning a web, but I wasn't sure if the spider begins by making the major strands and then connecting them, or whether it starts at the middle and winds it's way outward in a spiral fashion. Nonetheless, the important thing for me was that it had the inter-connectedness that I felt was so important. My thoughts turned back to the major strands versus the connecting strands. Were the topics the major strands or the interconnecting strands? What was the centre, the abstract or the summary?

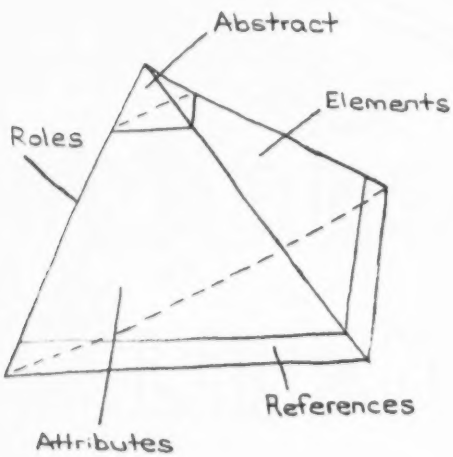
But, as so often happens, for some reason I thought of Laszlo's statement that there is a hierarchy in all systems, levels which are sub-levels of other levels and so on (1972). The web was levelled, hierarchical, but if we rotated it in space so that it became three dimensional, which hypertext is, then I saw the structure of a pyramid. Each of the three faces was one of the three topics: **Elements**, **Attributes** and **Roles**. There was a levelled paradigm, a hierarchy, and yet at the same time a unity, and an inter-connectedness.

I sketched out the pyramid in three dimensions, and drew levels between the top and the bottom. In so doing, I drew the same line around all the two faces of the pyramid that are visible, but then I thought, Why does each face have to have the same number of levels? My response was that perhaps it doesn't, that each level is unique for each face, in that case then, the elements face would have 5 levels (hypertext, hypermedia), the attributes face 5 levels, and the roles face 2 levels.

But what about the top and the base? All three faces converged to a single point. What was that single point? My thoughts turned to the **Abstract**, because that was a synthesis of the entire article. It was in that abstract that all aspects of the article were described. Perhaps that was the cone. For the moment I had forgotten about the **Summary**. And the base? I thought of the basic supporting elements, those aspects common to each and every face, the building blocks of the pyramid, the connecting elements. My answer: the **References**. The base of the pyramid was constituted by the **References**, the contributions of the many academics who had experienced hypertext authoring and whose insights I had synthesized into the article. The references supported the

article, they linked it all together, and, as Byles wrote, these links are not extrinsic to the poem, they constitute the poem.

From that point on, I felt confident that my model of the pyramid would serve me well. I began to plan in more detail as to what the form of the stack would look like. The top, or cone of the pyramid would be the **Abstract**. From there, branching away were the three topics, each with several levels. I kept the linearity of the article in supposing that the first level after the cone was the first sub-topic, and so on. At the bottom, the **References**, in their entirety, so that if the reader of the hypertext so chose, they could go directly to the source material, the foundation. This is my design.



So concluded what could be termed, "authoring in the large". Now began the next phase: authoring in the small.

I began the process of creating the hypertext by sketching out on a piece of paper the rough design for my card. I decided on a background that would be consistent throughout my stack. I used a triangle and a circle to exemplify both the metaphor of the design, and my own philosophical perspective on the nature of the process, and of knowledge itself. I placed each of the three topics on one side of the triangle, and wanted to highlight them by using a distinctive text style. I decided to use a field to display the information in, but also to always have available the options for the reader of being able to go to any of the topics at any time. This was the free-form approach of the 'inferential' perspective coming through, in contrast to the referential approach of allowing the reader to go through in a linear, levelled fashion. I thought about making the three topics as buttons, always active, so that a reader could click on one at any time and go directly to the beginning of that topic. Once I had decided on the general format and design of the stack, I began to work in HyperCard.

I "tore off" the Tools menu so that it was always accessible to me on the screen. In the background, I created the triangle and the circle using the graphics tools available in the Tools menu. I created and placed the three main topics along each of the three sides of the triangle, and gave them a distinctive shadow style. The background complete, I returned to the foreground. I decided on making a scrolling field to store the text that I would import from the Microsoft Word document. A thought occurred to me as I was working that perhaps some readers might simply want a basic summary of the topics, and that this concise, linear presentation of the basics of the article could be a central support from which the topics might spin off. It was sort of like installing an

elevator inside the pyramid! This is where the **Summary** belonged, an integral part of the article which I had simply overlooked during this last phase of the process.

I Quit HyperCard, Opened my document, and Copied the text from the **Summary** into the clipboard. I then Quit Word, Opened my stack and Pasted the text into the scrolling field.

I created a series of new, blank cards, each with a field in them, and then began the process of cutting the text from the scrolling field and pasting it into each of the blank cards. I used each paragraph as the basic content for each of the nodes I was creating, as much for the amount of text as for the fact that the paragraphs were unique, coherent bodies of information. The thought did not occur to me that this was very important as a means of identifying individual concepts within the hypertext, a fact that became very important once I had finished the cutting and pasting and then began to wonder how I was going to link the texts together.

It was at this point that the whole issue of links became very obvious. What was I going to link, why, and how? The individual nodes were obvious choices, but there were terms and concepts in each of the nodes that referred to other nodes in the summary, or to important concepts in the elements, attributes and roles topics. Not to link them would have negated the raison d'etre of hypertext, but to link them meant that I ran the risk of allowing my readers to bounce all over the place without the possibility of returning from whence they had come. The problem that occurred to me was to get the reader back to the place they had left. The classic case was the term "hypertext". If I wanted to link every instance of that term to a node which described hypertext, I would have no way of returning the reader back to their original place, unless I made multiple copies of that one hypertext node. HyperCard did not have the capability of remembering where the reader left and of returning there easily. Another problem that popped up was what to include and what to exclude. I could conceivably link almost every word in every node with some other term in every other node, it would be like an enormous bowl of spaghetti! I decided to defer the question of links until I had transported all of the text from the **Elements** topic into the stack.

I began the process again of copying the text from MicroSoft Word, pasting it into a scrolling field in HyperCard, creating new cards and then cutting and pasting the text into them. As I was working, the notion that each node was a separate topic that could only be linked if it was identified as such became very important. After I had created all of the new cards and made a consistent format (**shadow** fields, and Palatino 14 text style and size), I began the process of putting identifying banners on each node. This made the whole problem of linking much more apparent, but now I had an easy reference point to go to. I decided on a hierarchy at this point, so as to make explicit to the reader that there were levels in the hypertext. Consequently, the major sub-topics of hypertext and hypermedia were in **shadow** type, while the sub-sub-topics such as nodes, linkages, structure, graphics, sound, etc, were in ***bold, italic***

print. After I had "labelled" all of the cards, I went through each card and highlighted with **bold** type those terms which I could link to. I then created links between each of the terms highlighted and the nodes they referred to, but still the problem of not allowing the reader to return to the node they came from was not solvable. The last addition for linkages was the creation of a button which would allow the reader to return directly back to the **abstract**, or overview card. This gave the effect of being able to go back up to the cone of the pyramid to move down any face. But once I did that, I realized that the reader might also want to access any of the levels in any of the topics, so I created a series of buttons which would allow the reader to move directly to any sub-level of any of the three topics.

The process was fascinating, and engaging. At this point I had been working without a break for almost 5 hours! I had no idea that the time had gone by so quickly. I decided to take a break, and reflect back on what had transpired to this point in time. Several thoughts occurred to me:

- The process was definitely fun, and absorbing, and engaging, and empowering! I can rarely remember a project that pulled me in so that time just flew by. I became engrossed in little details like going into the Fat Bits option and filling in individual pixels so that letters would be consistent, or moving and adjusting text fields so that they were balanced. I was elated and proud when things worked, and frustrated when more and more questions arose. I can see now why and how my students could spend an entire hour of their meagre lab time working on the most minute details!

- The process was dynamic, full of questions, concerns and issues, most of which only appeared during the actual composition. There was no way I could have anticipated the myriad of questions which emerged as I was authoring. I had planned a basic outline, and the rudiments of a screen outline, but this process was for more dynamic, far more immediate. As one of my Education students remarked, "If learning is doing, then boy did I learn a lot because I've never done so much in my life!" I agree whole heartedly.

- The process was most certainly recursive. I was always re-viewing, revisiting, and re-vising my work. It was most definitely a case of "folding back" as Dr. Kieren has described. Each time I resorted to a more basic level, my understanding grew, and I was able to see other possibilities, other opportunities much more clearly.

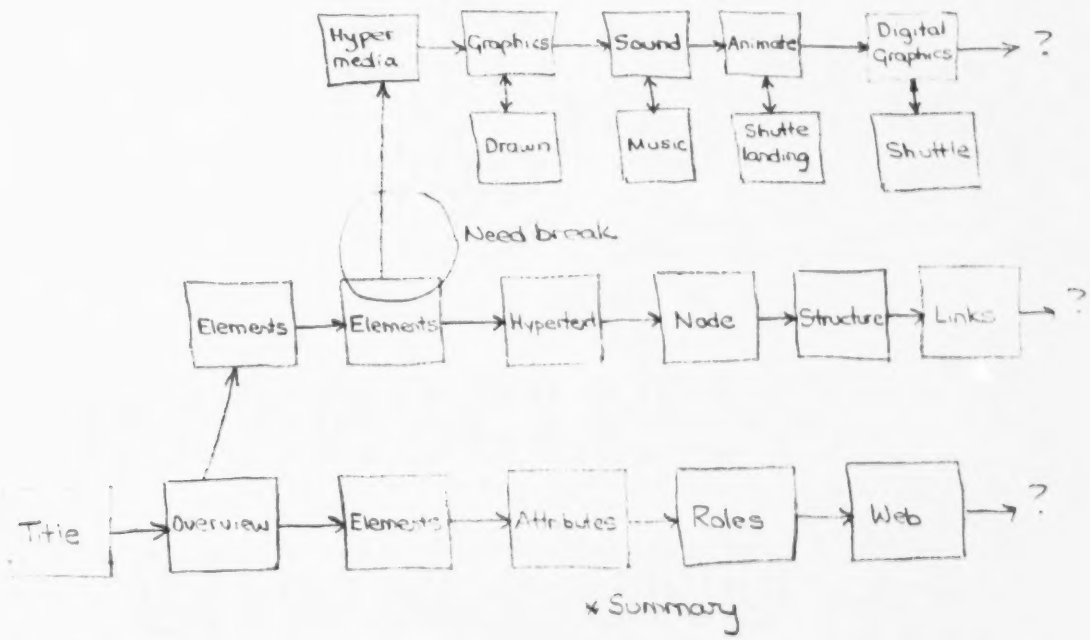
- While conceptually the notion of integration, connectedness and flexibility seemed simple enough, in practice, it was an incredibly difficult thing to do, especially if one was looking for a coherency and unity to the whole stack.

- Hypertext presented a wealth of problems (or opportunities!) as regards it's organization, presentation, and connectedness. I cannot begin to imagine how much more difficult working in a hypermedia environment must be.

- I appreciated the concept of authoring at large and authoring in the small. They were definitely complementary, mutually internested but separate and distinct. Many, many times I found myself moving back into the authoring at large perspective based on issues which emerged while working on individual nodes, and then translating those larger issues into the specifics of screen design and links.

This process was recursive in and of itself, because even though the two aspects were separate entities, there was a continual recursivity to my thinking and understanding in each aspect. Not only were they complementary, but they were each dynamically recursive.

I decided at this point that before I continued, I would sketch out what I had accomplished so far.



* -What about going back? Need return buttons on every card

* - Need to link text between nodes

* - What about return to where you leave?

↳ Navigation?

Nodes?

REFERENCES?

↳ Race but how do you access?

↳ Also when?

Several things occurred to me as I was drawing out the model: (1) there was no way to go back to the previous card, so I added those links to make the linear process two-way; (2) I needed to provide a break point in the **Elements** strand so that the reader could choose to go to either hypertext (which was logically the next step in the progression), or to move ahead to hypermedia; (3) I needed to incorporate graphics, sounds, animated sequences and digitized graphics as examples from the work of my students to elaborate on those terms in the hypertext; (4) I needed to link the terms in each node with those nodes that they referred to, so every instance of the term, graphics, would become a button that would take me to that node. Again, the problem of not being able to return to the departure point was a problem, but I decided to allow the reader the choice as to where to go, and why.

I returned to the computer, and began to make those changes. As I worked, I also began to edit the material in the nodes, and in one instance, I deleted the node altogether. (I then wondered if that meant that the paragraph was irrelevant in the original article because it did not connect smoothly in the hypertext, an interesting thought!) I combined nodes, and switched some text from one node to another to improve the consistency.

Once completed, with all of the nodes "labelled" and "linked", and with the proper consistency of presentation and format, I turned my attention to the **Attributes** and the **Roles** strands.

I will spare you the details of those processes if only because they went incredibly well! Once the basic format and procedures had been established in the **Summary** and **Elements** strands, the other two topics were essentially a matter of replication. The only important aspect to this stage of the process was the cross linking between topics, so that if the term "**hypertext**", for example (note the bold type to indicate a sub-topic), was mentioned in the text of **Attributes**, then I linked it to that node in the **Elements** strand. In this way, then, I was providing those "cross-strands" that maintained the unity, and interconnectivity of the entire structure.

The final process was the creation of the **References** nodes, individual cards for each reference that could be accessed by clicking on the references in the text of the nodes. Again, the inability of HyperCard to allow for two way links from a variety of sources meant that I was unable to provide a single node for every reference. Instead, I was forced to create individual nodes, one copy for each reference, and then link them directly to the originating node. But this was not the "base" support aspect I had in mind when my paradigm of the pyramid first began to take shape. I had intended for the reader to be able to browse through the source material according to their own personal inclination, so I made one, final, major revision to the entire stack. I created another button from the abstract, or overview node that allows the reader to access all of the **References** in an index-type format. In this way, the pyramid is complete, for while the four main aspects

(Elements, Attributes, and Roles, and Summary) constitute the faces of the pyramid, and the **Abstract** the cone, the source **References** constitute both the base, and the corners which connect the cone to the base.

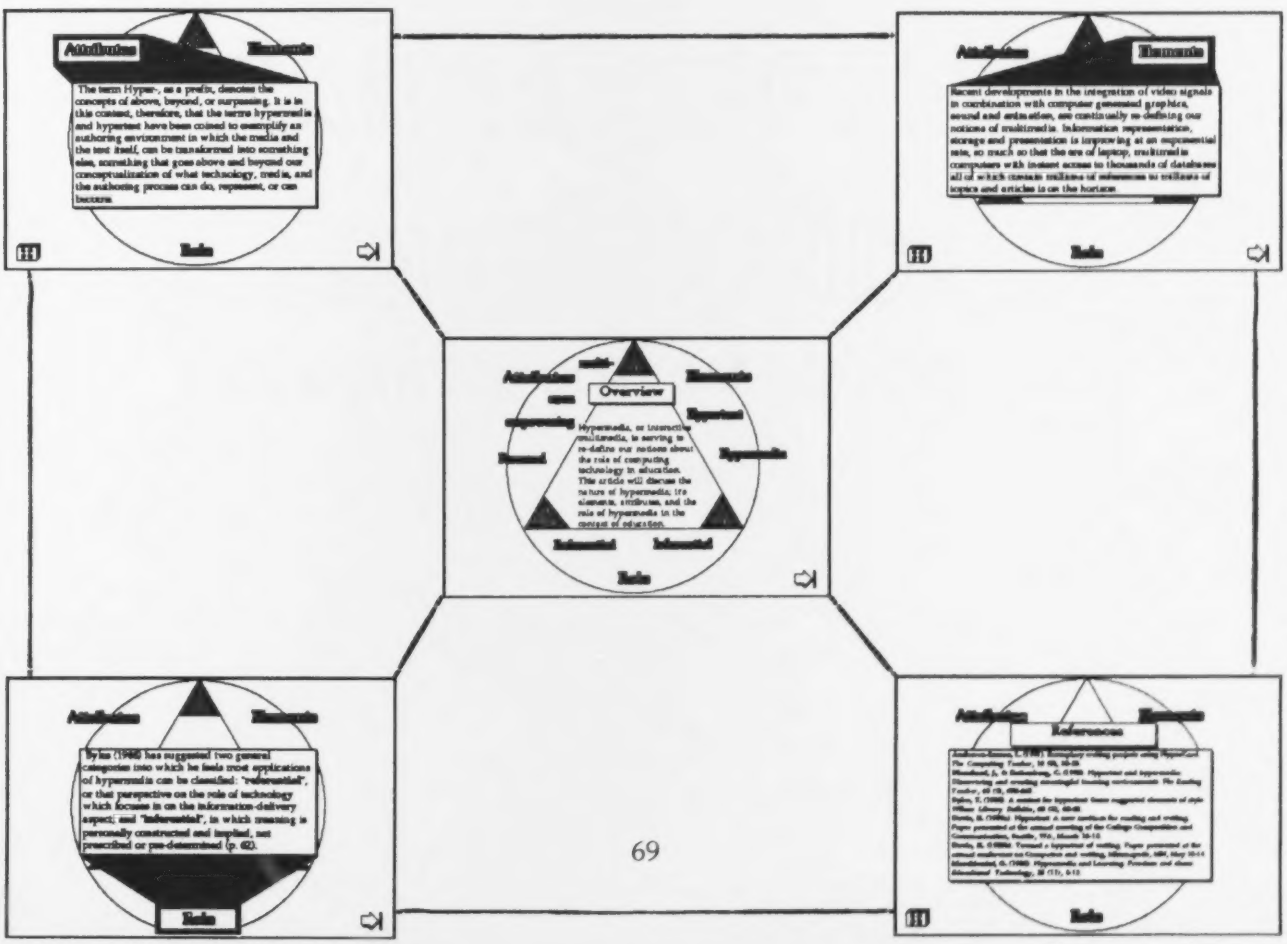
Summary

Perhaps the fact that this whole narrative took almost 14 hours to unfold says it all. The process was engaging, it was open and dynamic, it was empowering, it was Personal, and it was enlightening. In that sense, therefore, it had all the attributes of the hypermedium itself!

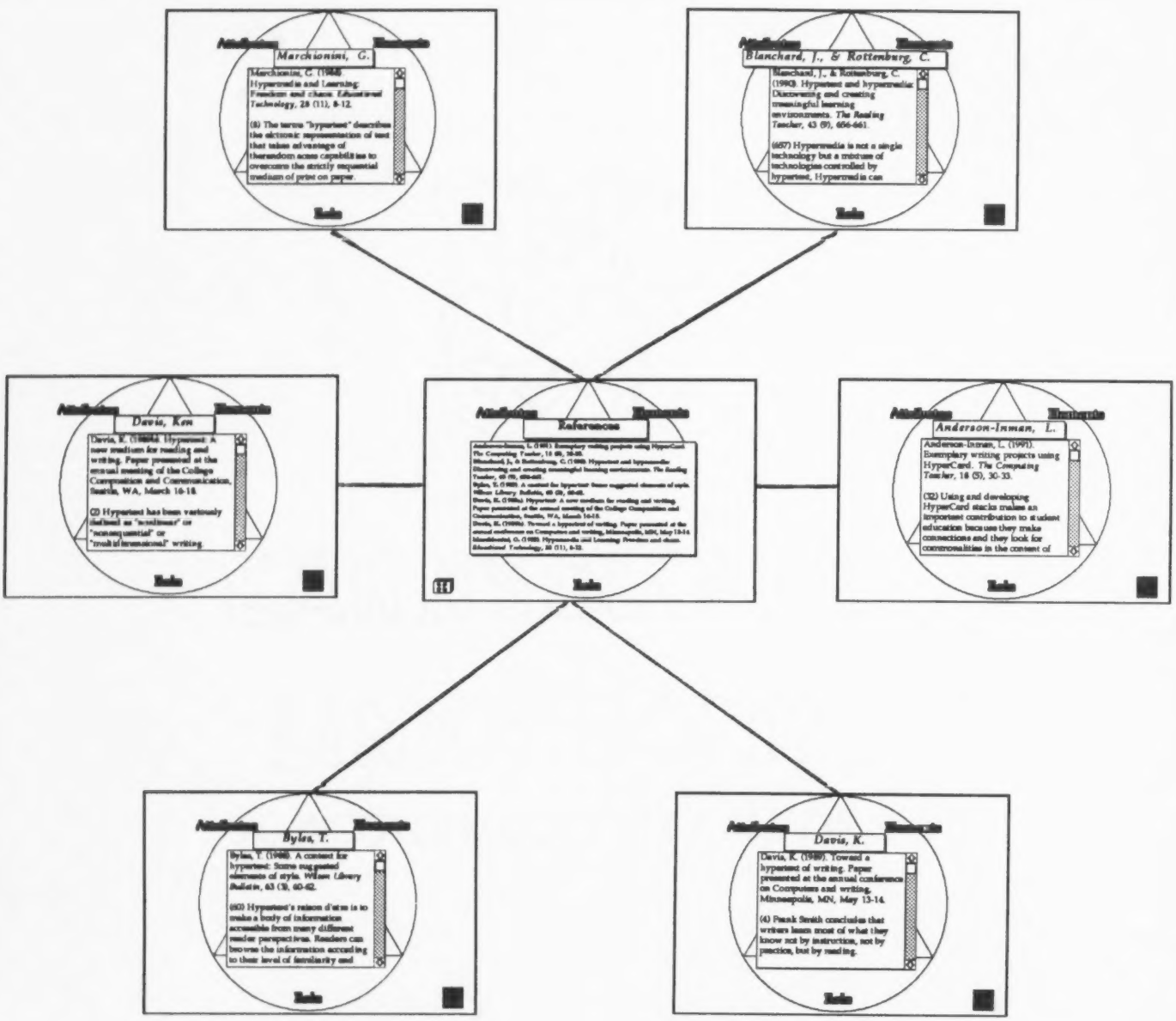
The insights that emerged are noted in the body of the narrative. The final product is reproduced in paper-based format on the following pages, and in it's HyperCard format in the accompanying diskette. Because of the impossibility of representing the stack in it's pyramidal, three-dimensional form, I have found it necessary to lay it down in two dimensions, and add the links as best as I could, to give the idea of the linkages.

The only other alternative would have been to create what would have been the most accurate image or metaphor, a holographic image, but time and budgetary constraints make that impossible! Following are the outlines for each of the major strands in the web: spinning a web of meaning.

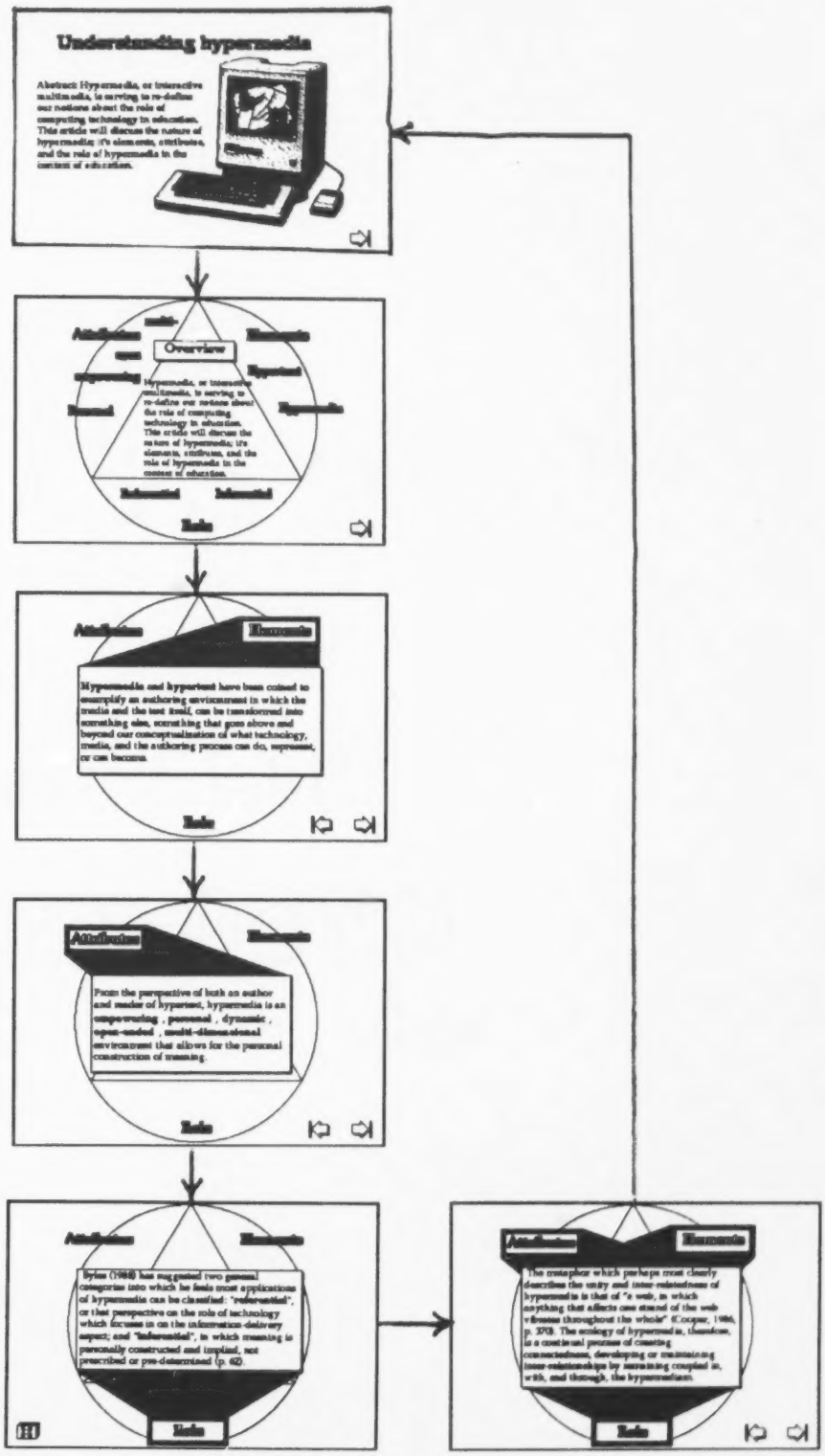
Overview


Attributes
Elements
The term Hyper-, as a prefix, denotes the concepts of above, beyond, or surpassing. It is in this context, therefore, that the terms hypermedia and hypertext have been coined to exemplify an authoring environment in which the media and the text itself, can be transformed into something else, something that goes above and beyond our conceptualization of what technology, media, and the authoring process can do, represent, or can become.
Roles
Elements
Recent developments in the integration of video signals in combination with computer generated graphics, sound and animation, are continually re-defining our notions of multimedia. Information representation, storage and presentation is improving at an exponential rate, so much so that the era of laptop, multimedia computers with instant access to thousands of databases all of which contain millions of references to millions of topics and articles is on the horizon.
Roles
Overview
Hypermedia, or interactive multimedia, is serving to re-define our notions about the role of computing technology in education. This article will discuss the nature of hypermedia; its elements, attributes, and the role of hypermedia in the context of education.
Roles
Attributes
Elements
Sykes (1988) has suggested two general categories into which he feels most applications of hypermedia can be classified: "referential", or that perspective on the role of technology which focuses in on the information-delivery aspect; and "referential", in which meaning is personally constructed and implied, not prescribed or pre-determined (p. 62).
Roles
References
Roles

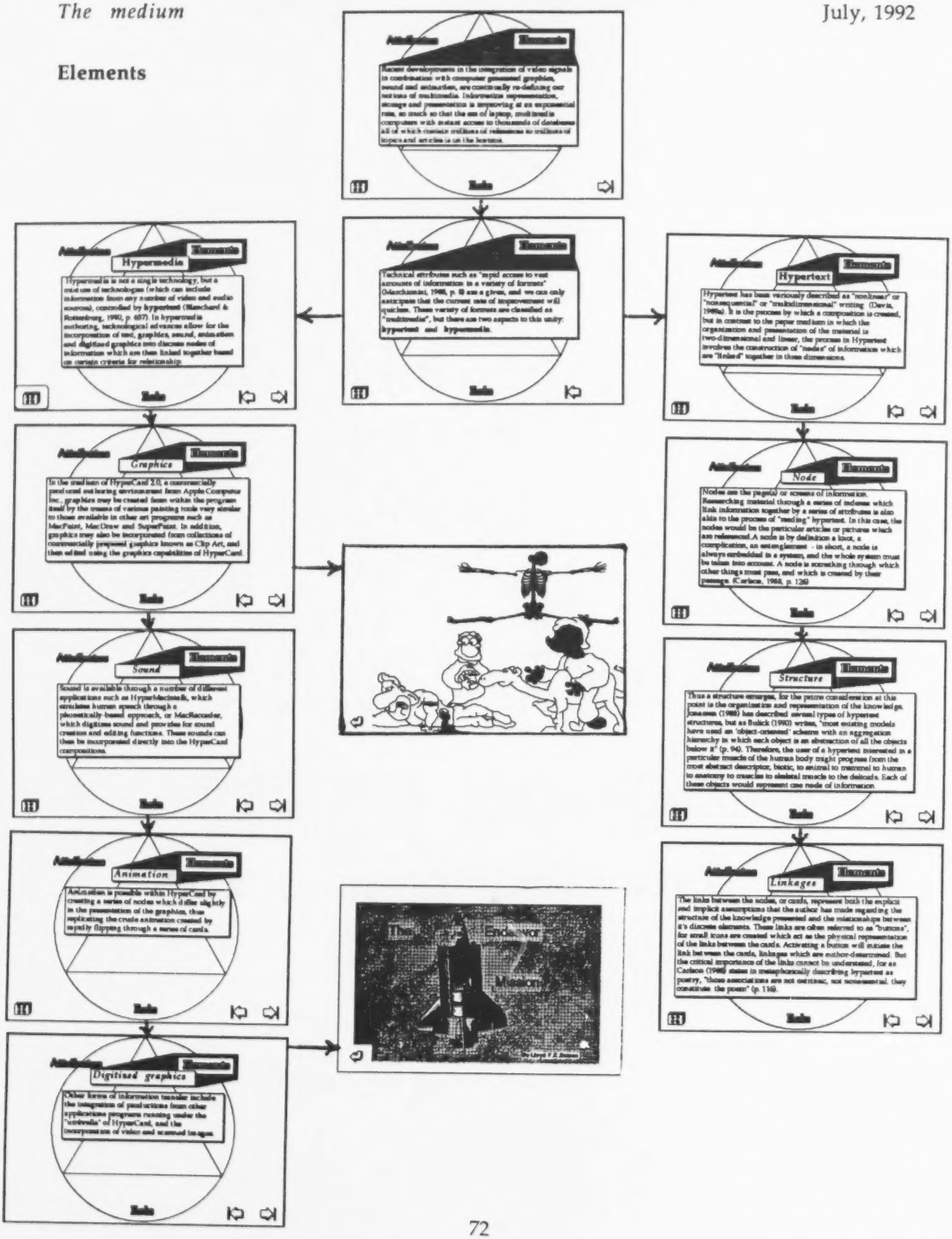
References


Marchionini, G.
Marchionini, G. (1988). Hypermedia and Learning: Freedom and chaos. *Educational Technology*, 28 (11), 8-12.
(8) The terms "hypertext" describes the electronic representation of text that takes advantage of the random access capabilities to overcome the strictly sequential medium of print on paper.
Blanchard, J., & Rottenburg, C.
Blanchard, J., & Rottenburg, C. (1990). Hypertext and hypermedia: Discovering and creating meaningful learning environments. *The Reading Teacher*, 43 (9), 656-661.
(657) Hypermedia is not a single technology but a mixture of technologies controlled by hypertext. Hypermedia can
Davis, Ken
Davis, K. (1988). Hypertext: A new medium for reading and writing. Paper presented at the annual meeting of the College Composition and Communication, Seattle, WA, March 16-18.
(2) Hypertext has been variously defined as "nonlinear" or "nonsequential" or "multidimensional" writing
References
Anderson-Inman, L.
Anderson-Inman, L. (1991). Exemplary writing projects using HyperCard. *The Computing Teacher*, 18 (5), 30-33.
(32) Using and developing HyperCard stacks makes an important contribution to student education because they make connections and they look for commonalities in the content of
Bylas, T.
Bylas, T. (1988). A context for hypertext: Some suggested elements of style. *Wilson Library Bulletin*, 63 (3), 60-62.
(60) Hypertext's raison d'etre is to make a body of information accessible from many different reader perspectives. Readers can browse the information according to their level of familiarity and
Davis, K.
Davis, K. (1989). Toward a hypertext of writing. Paper presented at the annual conference on Computers and writing, Minneapolis, MN, May 13-14.
(4) Frank Smith concludes that writers learn most of what they know not by instruction, not by practice, but by reading.

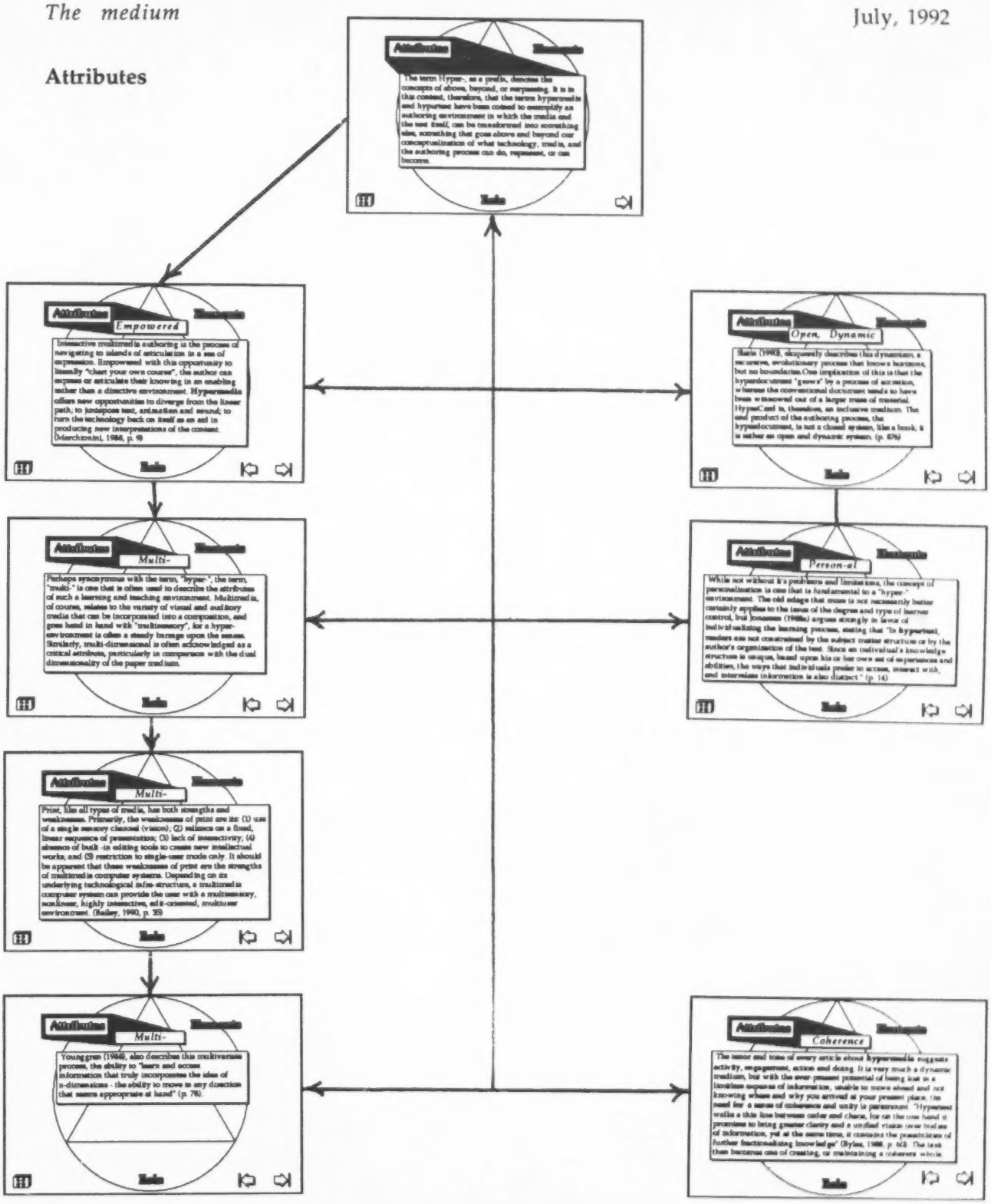
Summary


Understanding hypermedia
Abstract Hypermedia, or interactive multimedia, is serving to re-define our notions about the role of computing technology in education. This article will discuss the nature of hypermedia; it's elements, attributes, and the role of hypermedia in the context of education.
Overview
Hypermedia, or interactive multimedia, is serving to re-define our notions about the role of computing technology in education. This article will discuss the nature of hypermedia; it's elements, attributes, and the role of hypermedia in the context of education.
Hypermedia and hypertext have been coined to exemplify an authoring environment in which the media and the text itself, can be transformed into something else, something that goes above and beyond our conceptualization of what technology, media, and the authoring process can do, represent, or can become.
From the perspective of both an author and reader of hypertext, hypermedia is an empowering , personal , dynamic , open-ended , multi-dimensional environment that allows for the personal construction of meaning.
Byles (1988) has suggested two general categories into which he feels most applications of hypermedia can be classified: "reinvented", or that perspective on the role of technology which focuses in on the information-delivery aspect; and "reinvented", in which meaning is personally constructed and implied, not prescribed or pre-determined (p. 62).
The metaphor which perhaps most clearly describes the unity and inter-relatedness of hypermedia is that of "a web, in which anything that affects one strand of the web vibrates throughout the whole" (Cooper, 1986, p. 370). The ecology of hypermedia, therefore, is a contextual process of creating connectedness, developing or maintaining inter-relationships by remaining coupled to, with, and through, the hypermedium.

Elements


Hypermedia
Graphics
Sound
Animation
Digitised graphics
Hypertext
Node
Structure
Linkages

Attributes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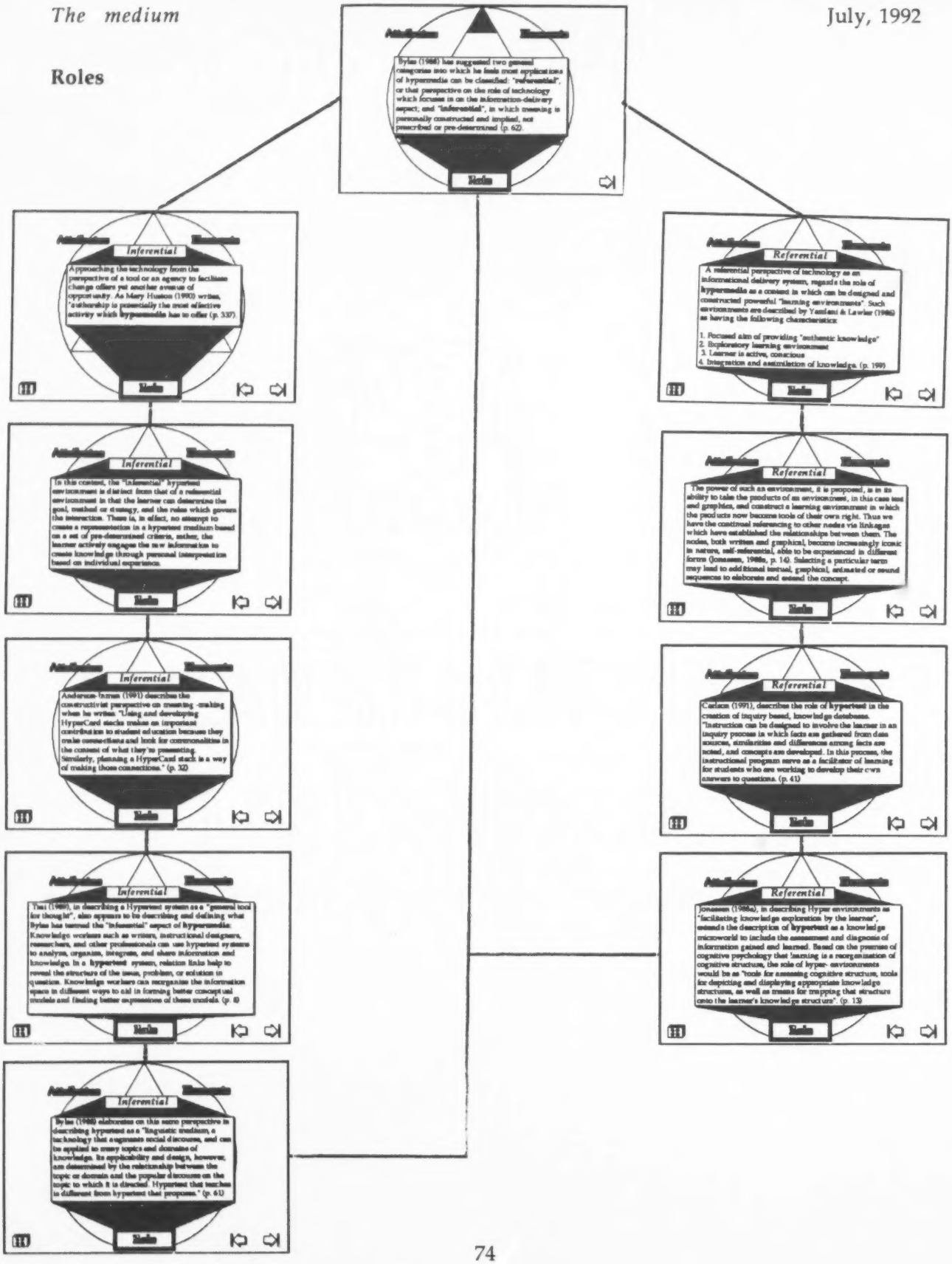
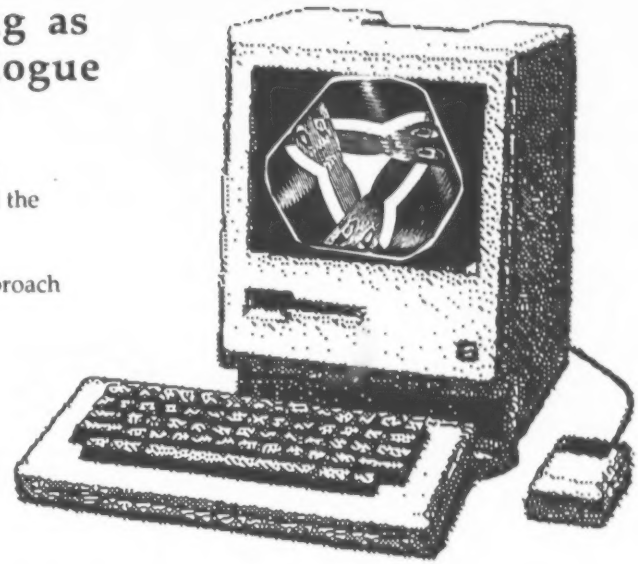
Rules
Empowered
Interactive multimedia authoring is the process of navigating to islands of articulation in a sea of expression. Empowered with this opportunity to literally "chart your own course", the author can express or articulate their knowing in an enabling rather than a directive environment. Hypermedia offers new opportunities to diverge from the linear path; to juxtapose text, animation and sound; to turn the technology back on itself as an aid in producing new interpretations of the content. (Marchionini, 1988, p. 9)
Open, Dynamic
Slatin (1988), eloquently describes this dynamism, a recursive, evolutionary process that knows horizons, but no boundaries.One implication of this is that the hyperdocument "grows" by a process of accretion, whereas the conventional document tends to have been winnowed out of a larger mass of material. HypusCard is, therefore, an inclusive medium. The end product of the authoring process, the hyperdocument, is not a closed system, like a book, it is rather an open and dynamic system. (p. 876)
Multi-
Perhaps synonymous with the term, "hyper-", the term, "multi-" is one that is often used to describe the attributes of such a learning and teaching environment. Multimedia, of course, relates to the variety of visual and auditory media that can be incorporated into a composition, and goes hand in hand with "multisensory", for a hyper-environment is often a steady barrage upon the senses. Similarly, multi-dimensional is often acknowledged as a critical attribute, particularly in comparison with the dual dimensionality of the paper medium.
Person-al
While not without it's problems and limitations, the concept of personalization is one that is fundamental to a "hyper-" environment. The old adage that more is not necessarily better certainly applies to the issue of the degree and type of learner control, but Jonassen (1988a) argues strongly in favor of individualizing the learning process, stating that "In hypertext, readers are not constrained by the subject matter structure or by the author's organization of the text. Since an individual's knowledge structure is unique, based upon his or her own set of experiences and abilities, the ways that individuals prefer to access, interact with, and internalize information is also distinct." (p. 14)
Multi-
Print, like all types of media, has both strengths and weaknesses. Primarily, the weaknesses of print are its: (1) use of a single sensory channel (vision); (2) reliance on a fixed, linear sequence of presentation; (3) lack of interactivity; (4) absence of built -in editing tools to create new intellectual works; and (5) restriction to single-user mode only. It should be apparent that these weaknesses of print are the strengths of multimedia computer systems. Depending on its underlying technological infra-structure, a multimedia computer system can provide the user with a multisensory, nonlinear, highly interactive, self-oriented, multiuser environment. (Bailey, 1990, p. 39)
Multi-
Youngren (1988), also describes this multivariate process, the ability to "learn and access information that truly incorporates the idea of n-dimensions - the ability to move in any direction that seems appropriate at hand" (p. 78).
Coherence
The tenor and tone of every article about hypermedia suggests activity, engagement, action and doing. It is very much a dynamic medium, but with the ever-present potential of being lost in a literature expanse of information, unable to move ahead and not knowing where and why you arrived at your present place, the need for a sense of coherence and unity is paramount. "Hypertext walks a thin line between order and chaos, for on the one hand it promises to bring greater clarity and a unified vision to new bodies of information, yet at the same time, it contains the possibilities of further fractionalizing knowledge" (Byles, 1988, p. 60). The task then becomes one of creating, or maintaining a coherent whole

Roles


Bybee (1988) has suggested two general categories into which he feels most applications of hypermedia can be classified: "referential", or that perspective on the role of technology which focuses in on the information-delivery aspect, and "inferential", in which meaning is personally constructed and implied, not prescribed or pre-determined (p. 62).
Inferential
A approaching the technology from the perspective of a tool or an agency to facilitate change offers yet another avenue of opportunity. As Mary Huston (1990) writes, "authorship is potentially the most effective activity which hypermedia has to offer (p. 337).
Inferential
In this context, the "inferential" hypertext environment is distinct from that of a referential environment in that the learner can determine the goal, method or strategy, and the rules which govern the interaction. There is, in effect, no attempt to create a representation in a hypertext medium based on a set of pre-determined criteria, rather, the learner actively engages the new information to create knowledge through personal interpretation based on individual experience.
Inferential
Anderson-Inman (1991) describes the constructivist perspective on learning -making when he writes "Using and developing HyperCard stacks makes an important contribution to student education because they make connections and look for commonalities in the content of what they're presenting. Similarly, planning a HyperCard stack is a way of making those connections." (p. 32)
Inferential
Yost (1989), in describing a Hypertext system as a "general tool for thought", also appears to be describing and defining what Bybee has termed the "inferential" aspect of hypermedia: Knowledge workers such as writers, instructional designers, researchers, and other professionals can use hypertext systems to analyze, organize, integrate, and share information and knowledge. In a hypertext system, relation links help to reveal the structure of the issue, problem, or solution in question. Knowledge workers can reorganize the information space in different ways to aid in forming better conceptual models and finding better expressions of these models. (p. 8)
Inferential
Bybee (1988) elaborates on this same perspective in describing hypertext as a "linguistic medium, a technology that augments social discourse, and can be applied to many topics and domains of knowledge. Its applicability and design, however, are determined by the relationship between the topic or domain and the popular discourse on the topic to which it is directed. Hypertext that teaches is different from hypertext that proposes." (p. 61)
Referential
A referential perspective of technology as an informational delivery system, regards the role of hypermedia as a context in which can be designed and constructed powerful "learning environments". Such environments are described by Yazdani & Lawler (1986) as having the following characteristics:
1. Focused aim of providing "authentic knowledge"
2. Exploratory learning environment
3. Learner is active, conscious
4. Integration and assimilation of knowledge. (p. 199)
Referential
The power of such an environment, it is proposed, is in its ability to take the products of an environment, in this case text and graphics, and construct a learning environment in which the products now become tools of their own right. Thus we have the continual referencing to other nodes via linkages which have established the relationships between them. The nodes, both written and graphical, become increasingly iconic in nature, self-referential, able to be experienced in different forms (Jonassen, 1988a, p. 14). Selecting a particular term may lead to additional textual, graphical, animated or sound sequences to elaborate and extend the concept.
Referential
Carlson (1991), describes the role of hypertext in the creation of inquiry based, knowledge databases. "Instruction can be designed to involve the learner in an inquiry process in which facts are gathered from data sources, similarities and differences among facts are noted, and concepts are developed. In this process, the instructional program serves as a facilitator of learning for students who are working to develop their own answers to questions. (p. 41)
Referential
Jonassen (1988a), in describing Hyper environments as "facilitating knowledge exploration by the learner", extends the description of hypertext as a knowledge microworld to include the assessment and diagnosis of information gained and learned. Based on the premise of cognitive psychology that 'learning is a reorganization of cognitive structures, the role of hyper- environments would be as "tools for assessing cognitive structure, tools for depicting and displaying appropriate knowledge structures, as well as means for mapping that structure onto the learner's knowledge structure". (p. 13)

Teaching as learning as researching: A dialogue

Abstract: At any point in the research process, Stephen Kemp was at one and the same time a teacher, a learner, and a researcher. In conversation with *The medium* , Mr. Kemp discusses this approach to naturalistic inquiry.



The medium: Mr. Kemp, please describe for our readers the nature of your role during this past year at Bishop Pocock School.

Mr. Kemp: Well, it was, to say the least, multivaried. I was a grade 8 teacher as well as vice-principal on a 15% release basis, which meant that I basically taught all day, every day. In particular, I taught what you might call, "the basics", language arts, math, social studies and science. In addition, I was also conducting research towards my doctorate in elementary education, so I was very much both a learner and a researcher as well. Oh yes, I also taught two evening classes for the Department of Educational Communications at the University of Saskatchewan. But regardless of my activities, my research provided the focal point.

The medium: Busy boy! What was the topic of your research?

Mr. Kemp: Put technically, it was to look at the nature of the authoring process in a computer-based, interactive multimedia environment. What that means in plain Queen's English is the process of authoring using a computer, but authoring that included more than words and pictures, it also could include sound, animation, and digitized images from books.

The medium: So how could you be three separate entities at the same time? How could you be a teacher and a researcher and a learner and keep them "all straight"?

Mr. Kemp: Well, that's where my perspective on the nature of well, everything, comes in. You see, for me, it was never a question of trying to "keep things straight", keep things separate, or bridge the gap between them. Last year, I read a great deal about a systemic point of view, systemic meaning a systems

perspective, a holistic approach, where there is no such thing as separate entities which have to somehow be bridged because there is no gap between them. I think that a "bridging the gaps" perspective on things comes from a paradigm that has served it's time and purpose, a scientific paradigm based on the work of people like Galileo, who tried to measure everything, to Descartes, who looked at reality as a duality, a separation of elements like heaven and earth, mind and matter, and so on, and Newton, who calculated formulae for all of physical nature. My point is that as a western civilization, our perspective on the nature of reality, the way things work, was based on a scientific model that emphasized mechanism, absolutism, certainty, predictability, reduction, and a systematic approach to understanding and knowing. I think the best metaphor that I've read or heard was that the universe was like a giant clock, and the Almighty set the universe in motion and it was slowly unwinding according to a prescribed, pre-determined plan. But as science improved, so there emerged questions which Newtonian physics was not able to answer, in particular, the dual nature of light, such that light could exhibit at one and the same time, the attributes of a particle and a wave. There's the key, "and", not "or", and. But how can something have two aspects both of which are correct? Newtonian science wasn't able to answer those questions or account for what was being observed at the micro-scale. The old metaphor of the nature of reality as a machine no longer fitted. At the sub-atomic level, things were not absolute, they were not predictable, they were not reducible to formulae. The new nature of reality is described now as being emergent, evolutionary, trans-formational, trans-actional, holistic. The metaphor has changed too. Gary Zukav's book, The Dancing Wu Li Masters, uses the metaphor of a dance, sparkling energy dancing and transforming into matter and then back into energy again. In that book he asks a question: How can you know the dancer from the dance? That to me sums up this new perspective, this new paradigm, because for me the answer is quite simple. You can't. It is not a question of separation but of unity. The eastern philosophies have, for me, proved to be very enlightening, for they describe nature and reality in those terms.

So, if the scientific view of the essential nature of the universe was changing, then maybe our perspective on all processes which make up that reality needed to change as well, and that includes education and research. And I think it is changing. We hear now of collaboration, process education, emergent curriculum, even the new emphasis on qualitative or naturalistic inquiry, everything is being approached from a more open, dynamic, inquisitive perspective. So, at long last, to get back to your question, I did not see a separation between my roles as teacher and learner and researcher. This is the unity I was talking about. It was like the nature of light in that sense. I was, and could be, both a teacher and a learner and a researcher, just as light could be both a wave and a particle. It's and, not or, and there's the critical difference.

The medium: So you are talking about a new cosmology, a different world-

view about how things are out there in the world. Does this new paradigm have a name, a model?

Mr. Kemp: Yes, I am talking about a new cosmology, but the term "new" is all relative (that's a pun). Actually, the newness of this paradigm, this cosmology, dates back to the beginning of the twentieth century, but has gained impetus in recent years in a number of scientific and educational domains. As for a name, or a model, I think that three books I recently read come as close to naming this new perspective on the nature of reality. The first is a 1968 book by Ludwig von Bertalanffy from the University of Alberta, interestingly enough, entitled General System Theory. The second is a 1972 work by Ervin Laszlo called The systems view of the world. The name says it all. In both books they argue for a systemic cosmology, not systematic as in the Newtonian paradigm, but a holistic paradigm that looks at systems as connected wholes, that looks at relationships and situations. Among many others, a third book that has made a big impact on my thinking and doing in education, also by Laszlo, was a 1987 work entitled Evolution: The grand synthesis. Again, he talks about the nature of processes as being evolutionary, emergent, discontinuous, full of possibility and surprise. He talks about evolution as being opportunity, not destiny, and so in these two works I find what you might term the "label" and/or the model for this new cosmology: Nature-al, systemic, evolutionary. But they certainly are not the only proponents of this "new" world view. This perspective is evident in domains ranging from biology to language processing, from curriculum to technology. In chemistry and physics, one could quote Zukav, Prigogine and Stengers, Gleick, Bohm and Peat; in Biology, Maturana and Varela; in technology, Winograd and Flores, Hofstadter and the numerous proponents of hypermedia authoring environments; in language processing, Bruner, Calkins, Frank Smith, Donald Graves and Jerome Harste; in curriculum, Doll, Kieren and Sawada; in ecological concerns, Bateson and Rowe; and so on and so on.

The medium: But to get back to my earlier question, if you are the teacher, and you are in there teaching, and then you say you are also the learner who is learning at the same time, and you are also a researcher who is trying to make sense of, and understand what is happening in that situation, how could your findings be viewed as being valid and reliable?

Mr. Kemp: Once again, I think it important to discuss the nature of what we mean when we say something is valid and reliable. In a paradigm based on a quantifiable perspective of the nature of reality, research is valid if it can be said to have conformed to absolute, knowable standards of correctness and accuracy. Research is reliable if the same results can be produced by another researcher given the same experimental conditions and reducing the situation down to a series of dependent and independent variables. In viewing research in such a way, we are assuming that there is some external absolute against which this research can be measured. In the quantitative paradigm, these notions of reliability

and validity in research are entirely appropriate.

However, in a constructivist paradigm in which meanings are negotiated, then the nature of reliability and validity must necessarily change. Reliability now becomes the maintenance of the process, the conservation of the medium which is being observed, but within which the observer is playing a dynamic role. The medium generates the reliability and validity because only in the maintenance of the medium can the attributes of recursion and reflexivity be conserved. The process of observing and being observed is reliable and valid so long as the poiesis, the creative growth, is conserved. What researchers in this paradigm are faced with is trying to interpret the meaning of a situation as sensitively as possible, and to convey all of the elements and attributes of that situation so that the reader can construct for themselves the meaning of the event. I can interpret it my way, certainly, but I cannot give you my meaning. Meaning is personal, and experiential, and constructed, not static and de-contextualized. Meanings are negotiated in a process of transaction between the observer and the observed, but we are all observers. Humberto Maturana said that, but we are not passive, distanced observers. We are active, dynamic, intimate, effecting and affecting.

So for me, the notions of validity and reliability, therefore, transcend what might be viewed as alternate paradigms. It is the nature of the context, the nature of the research paradigm that their meaning becomes clear.

The medium: You alluded to the eastern philosophies as an alternate world view, different from the western world view that you said was scientific in nature. Is this the Nature-al, systemic, evolutionary paradigm?

Mr. Kemp: Yes, I have become very interested in the eastern perspective on the nature of reality, because I sense in it the attributes or qualities which findings from science are describing. Taoism, in particular, has become an interest of mine, and in fact I have tried to express my understanding of Taoist principles in my personal, and professional life. Taoism is a philosophy of harmony and balance, of quiet listening and reflection. Taoism is a philosophy of getting in touch with the natural unfolding of what is, in it's natural state of Being. It is a philosophy of non-interference, awareness, openness and simplicity. These are but a few of the many principles in Taoism which I think have a role or place in education, all aspects of education, teaching, learning, and research.

I approached my roles this year from a holistic Taoist perspective. I didn't think of myself as one third teacher, one third learner and one third researcher. I was me, and at times different aspects of me came to the fore, but they were still part and parcel of me, the essential me. It never occurred to me to step back and say something like, Hold it, what would Steve the teacher do here? I sought a harmony in our class community of teachers and learners and researchers, and I tried to have them appreciate a balanced perspective on their roles as well. I actively encouraged them to consider themselves as teacher and

researcher as well as learner. I regularly provided opportunities for all of us to reflect back on our journey together, both as individuals and as a group. I made a conscious effort to listen more than I spoke, to allow myself the opportunity to be a part of the process instead of trying to direct and manage it. At first that was a very hard thing to do, because I was used to being up front, leading the parade, but now I was in the parade, so that took some getting used to. In particular, that instance of listening outside the lab while a group of my students tried to figure out what sounds a camel made. That was a classic example of non-interference, of listening but not getting involved. I tried not to meddle, to interfere, but just to let things Be. I tried very hard not to try, does that make sense? I wanted to let things happen, not to be in there managing all the time. Yes, it was a fascinating experience, and I know that it had a tremendous impact both on me and my students. They referred to these things time and time again in their journals, and in their conversations with me.

The medium: So you are pleased that your approach to teaching and learning and researching gave you some insights into the process?

Mr. Kemp: Oh yes, more than I could ever reasonably express. It was so rich, there were so many insights into aspects of the year that I could never have imagined. The greatest difficulty I have is trying to separate these insights, not that I believe one should, but to try and disconnect them somewhat to examine them somewhat more closely, for they are hopelessly emmeshed, one into the other. I'm reminded of the mobius strip configuration by M.C. Escher, an art piece whose three planes appear to intertwine and fold in a continuous blending of surfaces and edges. Each of the three planes of that mobius strip would represent the teaching, learning and researching aspects of my journey through this year.

But for the sake of clarity perhaps we should briefly consider each one independent of the others, always keeping in mind that they are all complementary to each other. Teaching, for example, became a qualitatively different experience. It was far more open and dynamic, far more Personal with a capital P. I mean I put more of myself into teaching, and allowed the students the opportunity to put more of themselves into the process as well. That's another thing, process. My teaching this year was far more process-oriented. The products were important still, I mean I had to assess the final product for the report cards and the kids needed to know where they stood, "like, is it an A, like, or a B"? But they and I together began to see the vitality and importance of the process. This was what I tried to capture in some of the anecdotes I shared in my journal, you know, *The medium* !!! Anyway, my teaching was far more emergent and transactional, we often would plot our journey or direction as we were travelling it, deciding where we were going as we were stepping. In that sense then, it wasn't so much a question of "my" teaching as "our" teaching. And even if we got off on what one might describe as "tangents", we began to see what I think was the most important "lesson" from this year, that

everything is connected. You see, even there, you cannot separate teaching from learning, and either or both of those two from researching. Everything is all part of one larger unity, and myself, the students, what we did and how we did it were all aspects of a connected oneness. You couldn't separate them. You couldn't separate Mikey from his cartoon art. It was Mikey and Mikey was it. For the first time in my life, both personal and professional, and again I am making a distinction but there really isn't one, I experienced that overwhelming yet underlying sense of unity. That was the learning aspect, but it was intimately connected to the teaching aspect and the research aspect. That's why this past year was so exciting. My teaching was my researching as it was my learning and Being. It became so much more of a journey of Self-discovery, Self with a capital S.

I learned so much more about so many aspects of me as a person and as a teacher, about technology and it's role and potential as a medium of articulation, about the authoring process, about patience and listening, about drifting and listening. I learned about me in all my aspects, and I like to think the students did as well, about me and themselves. Time and time again they would write that in their journals, about how they were coming to understand themselves better, not because I gave them a course on adolescence and we discussed the quirks and characteristics of adolescents. No, they were learning more about themselves by looking in as well as out, by socializing and contributing, by Doing as well as not Doing. In that sense, then, it was recursive, they were growing, as was I, but we were re-defining new "us-es" in and through ourselves. We were writing the stories of ourselves, but it wasn't an introspective process, it was as much social, collaborative.

Researching was an integral aspect of my year, and perhaps more than any other, I felt energized, I felt as though I was really in tune with what and how I was doing things. I was able to reflect on a myriad of small, at first seemingly inconsequential events and sayings, little things that often grew and melded with others to form a dynamic, emergent puzzle. I listened more than I spoke, I was sensitive and attentive, but worked very hard not to meddle or interfere or direct the process. I recorded in many different media: my journal, audio recordings, video, documents, samples of work, anecdotes, the student's journals, reactions from fellow teachers and parents. At times it seemed overwhelming, but the format of this journal really helped provide a focus, a means, a Way.

What insights did I get? Well, I know it sounds cute, but maybe we didn't just get in-sights, maybe we got out-sights too!

The medium: Indeed, but getting back to the issue at hand, certainly there had to be some problems with this approach to research and educating?

Mr. Kemp: Oh yes, there were, many. Interestingly enough, the on-going issue which I was most aware of was the need to find ways and means of being able to sensitively describe and portray the events and sights and sounds of the year, the nature of the journey. In some cases, a picture would have been all I could have

wanted and more, but I didn't have a camera. In other cases it was what was being discussed, or shared, and I couldn't record it. And those moments were so fleeting. They could never be arranged or reconstructed, but when they had passed they were gone, and all I could do was note them in my journal, and reflect on them later, from a distance, but I would have loved to have been able to capture those times "as it happened". Another problem was exactly the reverse of the authoring process in hypermedia, trying to express a multimedia concept in two dimensions, i.e., this journal. My students were experiencing the multi-dimensionality of hypermedia authoring in contrast to the linearity, sequentiality and two-dimensionality of the traditional means of authoring, paper and pencil. This was an empowering process for them. But my situation was exactly the reverse. I was trying to capture all of the vitality and energy and inconsistency and multi-variety of the experience in a linear, sequential, two dimensional format. It was very, very frustrating at times, and I know that I never could do the situation justice. I just hope that I came as close as possible to describing the contexts that emerged in all of their infinite variety.

The medium: So it wasn't so much a case of accuracy as it was sensitivity?

Mr. Kemp: That's right. Sensitivity. I suppose being hyper-sensitive to the process implies that there is accuracy, but again, not so that the process could somehow be replicated and reproduced, I believe that such is impossible. No, I wanted to be as sensitive as possible so that I could bring color to the page that my readers (who now number in the thousands!) were reading. I wanted to make that energy sparkle!

The medium: But was this a solitary process?

Mr. Kemp: Oh no, in fact, I take great pleasure in the fact that my students were implicitly and explicitly between each and every line that I, and we, and they, wrote. I'll never forget the day when I brought in the first copies of the first issue. They were ecstatic. They were so proud to see their words, their actions, their thoughts and their productions in the journal. I didn't need a catalyst, or something to focus their energies, but even so, after that first issue came in last January, they became even more excited about contributing to the journal.

The medium: But what about the Hawthorne effect? Couldn't all of these marvellous compositions simply have been a consequence of the fact that this experience with the computers was new, and novel?

Mr. Kemp: No, it was so much more than that, because the energy, the engagement, the dynamism imbued all that we were doing and how we were doing it. It wasn't confined to the lab, it was there in all that we did together. For example, we did a concept mapping project on the connectedness of all living and non-living things on earth. There were the same attributes and qualities in that process as there was in hypermedia authoring. In that sense then, I agree with McLuhan when he wrote that

The medium is the message. I take from that the sense that the medium has within it certain attributes which massage the message, in other words, the message cannot be separated from the medium in which it was conceived and from which it emerged. In the larger context, then, I am a medium, as were all of my students, as was the classroom, the hallway, the lab, the school, the community and so on. The meta-medium that was this past year was one of collaboration, activity, energy, but made up of media all of which, or whom, were resonant with each other. They were, in the words of Humberto Maturana, coupled with their medium.

The medium: Are you saying that the computer experience was irrelevant?

Mr. Kemp: No, it was an integral part of the total experience, but no more, or less integral than myself, the students, and the school community within which our class community flourished. It was a medium unto itself that had special attributes which enhanced or fostered the process, but it was also a medium that was coupled with each and every one of the students. In the same way, I too brought special attributes to the journey, as did all of my students, and the context in which this process unfolded. You could not have removed one single entity without disrupting the whole system. There was an ecology which had emerged, an environment, a web or network of inter-related wholes.

The medium: And what about your role. How important were you to the process?

Mr. Kemp: I was another medium to be sure, but I also have to aware that my role was very important. I was the constructor of the context if you will. My perspective on this, though, was to allow the medium to evolve and emerge in a kind of self-referential, self-organizing kind of a way. I did not want to go in there and dictate the nature of the process, that would be defeating the whole point of the exercise. In effect, I set the process in motion, established some parameters and qualities, and then allowed the process to unfold. In terms of my rapport with my students, well I thoroughly enjoyed them, and I think they enjoyed being with me. We got along very well. So yes, I was important, because the process reflected me as person as much as I reflected it, and so it was very much a case of the dancer and the dance. Very quickly, you couldn't separate the process from me, or vice versa. It became a whole, an environment, an ecology. That term came to mean a great deal to me, ecology. I became very interested in this whole notion of connectedness, a web of relationships that affected all. This was very obvious in the latter stages of the journey when we did some very exciting projects in concept mapping and HyperCard.

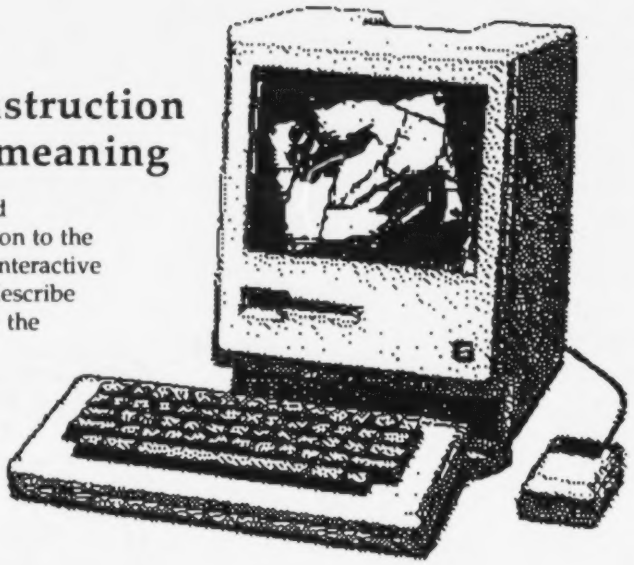
The medium: And so this emphasis on the ecological aspect of the process...

Kemp Yes, well, that's the next issue! I wouldn't want to steal my thunder!

The medium: Well, that was very interesting, thank you for your time.

Concept Maps and HyperCard: The construction and articulation of meaning

Abstract: Concept maps offer a unique, and potentially important means of introduction to the process and meaning of computer-based, interactive multimedia authoring. This article will describe the concept mapping approach, illustrate the applicability of concept mapping to the introduction, design and development of hypermedia for elementary school students, and conclude with a description of a computer-based, interactive, multimedia research project.



I had two critical questions before me: (1) How could I introduce the concept of a computer-based, multi-media authoring experience to my grade 8 students? (2) How could I describe and demonstrate the multi-dimensionality aspect of hypertext that made it such a unique medium for authoring?

Hypermedia was still a relatively new medium for my 22, grade 8 students. They had become very adept at working in the Macintosh environment, and had produced some absolutely fantastic compositions using graphics programs in combination with PowerPoint, a slide-show presentation application. In contrast to PowerPoint, however, not only was it a new level technically in their understanding of computer-based authoring environments, it was also a qualitatively different level.

Now there were multi-dimensions to be concerned about, multimedia packages of information that could now include sound and animation, tied together with strings that somehow related all the distinct pieces into one coherent whole.

The issue at hand was to find a way that I could introduce the essential concepts of hypertext authoring: multi-media and multi-dimensionality.

Concept mapping

My students and I had recently completed a "concept mapping" or "webbing" project dealing with John Steinbeck's classic novel, The Red Pony. I had used the concept mapping approach as a means of trying to demonstrate the implicit connections between what had seemed to my students as four, distinct short stories in one novel. After beginning with the title, and allowing the concepts to evolve from within the previous, and then looking back on the web to see how all of the four elements were represented in that unity, the students had been able to see the connections.

We had approached it as a whole group experience, and had noted the variety of interpretations and meanings which different students had attributed to different terms and events in the novel. But the main point of the exercise, the inter-relatedness of the various, discrete parts to the novel, had become graphically obvious.

We had just concluded this project when interpreting the HyperCard authoring process offered itself as another opportunity to elaborate on what had been a rich and rewarding experience. The difference this time, however, was that the process would be summative instead of formative. My idea was to use a concept map as a means of understanding the student's notions and conceptions of HyperCard.

At a surface level I could see the similarity between concept mapping and hypertext authoring, but I wanted to come to understand the "deep structure" of webbing. Interest in the power of concept maps had led me to undertake a research journey into the theoretical basis for such an approach, a project which had been fantastically successful in developing understanding, and constructing personal meaning. After a convoluted, often fruitless search, I was referred by a contact with the Saskatchewan Department of Education to "Learning how to Learn" by Novak and Gowin (1984).

> First, we are advancing the idea that the best way to help students learn *meaningfully* is to help them explicitly to see the *nature and role of concepts and the relationship between concepts* as they exist in their minds and as they exist "out there" in the world or in printed or spoken instruction. Second, we are advocating procedures that will help students to extract specific concepts (words) from printed or oral material and to identify relationships among those concepts. A third idea is that concept maps present a way to *visualize concepts* and the *relationships* between them. (p. 24)

The more I read, the more I found myself able to substitute, both conceptually and practically, concept mapping and hypertext authoring. The systemic nature of both webbing and authoring was described by Marilyn Cooper (1986) in her article, The ecology of writing.

> An ecology of writing encompasses much more than the individual writer and her immediate context. An ecologist explores how writers interact to form systems: all the characteristics of any individual writer or piece of writing both determine and are determined by the characteristics of all the other writers and writings in the systems. (p. 368)

Novak and Gowin continue by describing concept maps as "a schematic device for representing a set of concept meanings embedded in a framework of propositions" (p. 15). Conceptually, this particular reference could as easily apply to the authoring process as it does to the construction of concept maps. Marilyn Cooper (1986), in describing the ecology of writing, suggests that "the metaphor for writing suggested by the ecological model is that of a web, in which anything that affects one strand of the web vibrates throughout the whole" (p. 370). This is analogous to hypertext, for in the process of externalizing thought, the concept meanings become the nodes of information,

while the propositions become the linkages, the connections which "constitute the poem" (Slatin, 1988, p. 116). At the meta-level, the holistic approach of concept maps, authoring and hypertext is the same: "to visualize concepts and the relationships between them". The metaphor of the web serves them all equally well.

Novak and Glowin describe the use of concept maps as "tools for negotiating meaning, which can make possible new integrative reconciliations that in turn lead to new and more powerful understanding" (p. 104). Cooper describes the openness of such systems, "made and remade by writers in the act of writing" (p. 368). This was very evident in the process of developing our concept map on the environment. Many times the students would be noted asking for help, sharing ideas as to what the term meant and how it could best be described. The learning was collaborative, reciprocal and recursive. Some ideas were represented graphically through the use of hand-drawn or cut-out pictures from magazines, other times the students resorted to poetry and lyrics from popular songs. Taken together, both Novak and Glowin, Marilyn Cooper (1986), and Edward Barrett (1988) describe this new role for learning, teaching, technology, and their relationship to languaging and the construction of meaning.

> We have found it helpful to think about concept maps as tools for negotiating meanings. Learning the meaning of a piece of knowledge requires dialog, exchange, sharing, and sometimes compromise. (Novak & Glowin, 1984, p. 20)

> The ideal image the ecological model projects is of an infinitely extended group of people who interact through writing, who are connected by the various systems that constitute the activity of writing. For these "engaged writers" ideas are not so much fixed constructs to be transferred from one mind to the page and thence to another mind; instead, ideas are out there in the world, a landscape that is always being modified by ongoing human discourse. (Cooper, 1986, p. 372)

> In Vygotskian terms, the computer becomes a means for supporting a hyper-context of collaboration and dialogue - a social construction of knowledge. The role of writing in the development of computing technology, therefore, is revisioned. Writing - the textual, contextual process of externalizing thought - becomes the fundamental ground of development. (Barrett, 1988, p. 114)

In all three instances, the social aspect of the construction and negotiation of meaning are central to the conceptual basis upon which both hypermedia, authoring, and concept mapping are based. Even to the extent of describing the roles of learners and teachers, the observations and comments of Novak and Glowin could easily be attributed to authors of both "referential and inferential hypermedia" (Byles, 1988, p. 62).

> For the learner, they help to make evident the key concepts or propositions learned, and also suggest linkages between the new knowledge and what he or she already knows. For the teacher [author], concept maps can be used to determine pathways for organizing meanings and for negotiating

> meanings with students. (Novak & Glowin, 1984, p. 23)

Thus it became apparent that concept mapping, authoring, and hypertext were, conceptually and practically, synonymous.

The timing seemed perfect, for just as we had finished a webbing exercise in literature, the opportunity presented itself to doing likewise in both "Science" and "Computers". I put those terms in quotation marks because I had not made a distinction between them as separate entities, but the students always tried to differentiate for themselves as to what "subject" this particular project belonged.

In science, we had been discussing the inter-relatedness of all things, a topic which emerged from our discussions about environmental awareness. My idea was to adapt the concept mapping approach to graphically demonstrate both the multi-media and multi-dimensionality aspect of all processes, regardless of whether they happened to be in the so-called domains of science or computers. From our discussions we collectively agreed upon the topic sentence: **All things in this world, both biotic and abiotic, are connected.**

Figure 1 below is an overview of the process after each of the 22 students had produced at least two panels each.

Figure 1: The environment map

We linked the panels together using string to visually show the relationships or links between the elements, or panels. For example, one branch of the network began with the term "World", and from there linked to ozone layer, society, nationalities, aliens, and humans. Each of these terms was represented by an individual panel. From each panel, other connections were made. For example, Nationalities was linked to colors, hair, skin and culture, and so on and so on. Figure 2 below is a close up of the network just described.

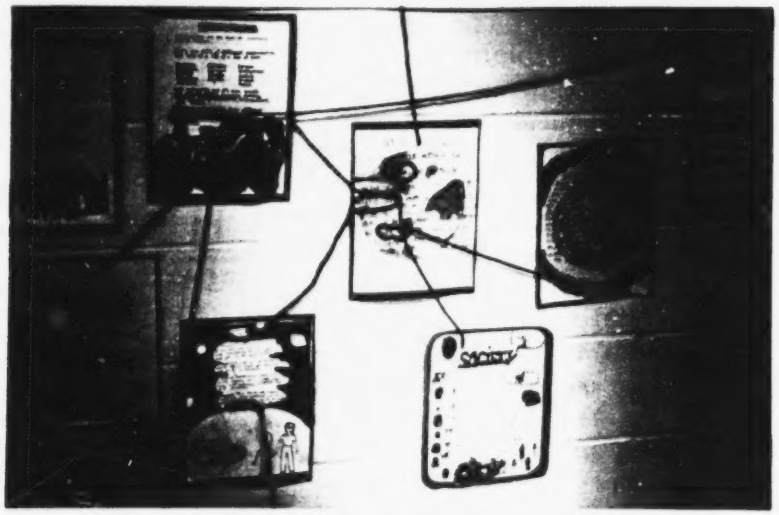


Figure 2: The network surrounding the term "World".

The process underway in science, my thoughts now turned to the possibilities of using a concept-map approach to introduce the initial hypertext authoring experience. The process was almost too simple! In less than a single hour, I had managed to introduce the students to the basic concepts and mechanisms of HyperCard. In referring back to both the "literature and science" projects, the concepts of systems, nodes and linkages were already a part of the student's understanding. They were able to already visualize in more than one medium, and in more than one dimension, but systemically and holistically at the same time.

As a focus for our learning, a "social studies" project dealing with countries of the world had become important because we were preparing for a multicultural display as our contribution to Education Week activities.

We began the research process by generating a series of categories which would serve as the research outline. Dividing the world into continents, and then listing as many countries as we could think of that belonged in that continent, we were able to arrive at a substantial list of possibilities. The students then began a long process of selecting and negotiating, because one of the criteria

for the project was that each country could only be selected by one student.

The students began the research phase of the project by looking for reference material in the library, in the community library, and at home. Several of my students began to research countries that there ancestors were born in, or their families had emigrated from. I repeatedly emphasized to the students that it was important not only to consider what information they were uncovering, but also the best ways and means of presenting the information. We talked about a variety of methods for communicating ideas and facts: graphs, charts, pictures, anecdotes, poetry, symbols and the like.

The students prepared their nodes for hypertext by designing the layout for each category on individual recipe cards. On these cards the students would try to present and arrange the information they had found. Because of the limitation of size and the amount of information available, the issue of presentation format was critical. Most students had difficulty in the basic question of what to include and what to exclude, but more and more I began to observe students attempting to condense a mass of material into an efficient, compact, yet complete format. This process was often social and collaborative, with students freely exchanging ideas and comments on the method chosen and the details therein. Students with limited drawing skills went to the lab to view Clip Art stacks to see if there were graphics that could be used or modified. Other students experimented with tracing or copying pictures, while others concentrated on applying the information to graphs and charts. This time was also a time of much learning and discussion concerning screen attributes, and issues such as the amount of information, display formats, type fonts, styles and sizes, and the type of, and rationale for, linkages, were matters of continuing concern.

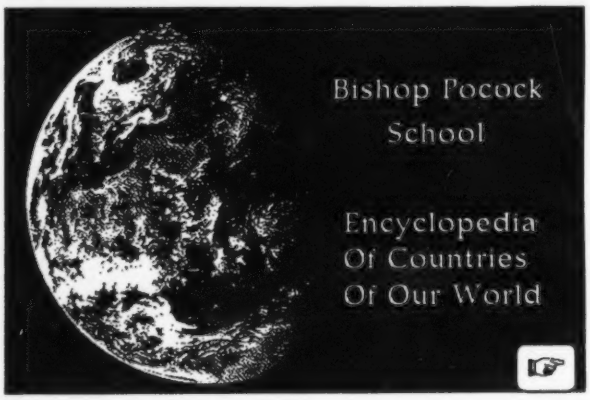
The inherent connectedness of the process quickly became apparent both to myself and to the other students, for I was an active student in this process myself. On several occasions, the topic of relatedness was to emerge, particularly in respect to how information applied to several categories, where it belonged, and why, and how this information could be accessed from different categories or cards. The nature of the linkages was also very important, although at this early stage in the understanding of hypertext, almost all of the students confined themselves to linkages which were simple, clear and explicit, for example, simply presenting a menu of choices or linkages to a related card on the same topic.

The attachment to the task that was demonstrated by all the students, who were working on the "science" project" simultaneously with the "computers" project, was intriguing. The students were invariably noisy, but it was a constructive, focused noise. There was much talking and sharing going on, most of it pertinent to the task at hand, but a lot of it simply "visiting". This was an aspect of the process that appeared to carry over from the classroom into the lab, as the example of trying to make the camel sound illustrated! It was social construction and collaboration personified!

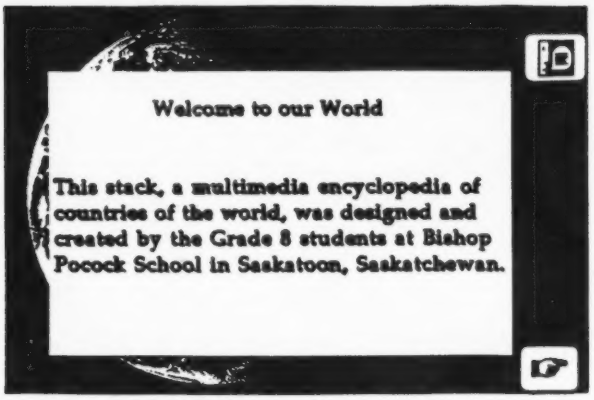
After a week of gathering, synthesizing and designing, the cards were then used as the basis for the work in the lab. My goals were simple: to become familiar with the basic HyperCard functions and facilities, and to experience the hypertext authoring process. Both were staggeringly successful. The skills and abilities learned from graphics applications and PowerPoint, plus the consistency of the Macintosh environment, meant that the students accommodated this new opportunity easily. The HyperCard concepts of cards with backgrounds and foregrounds, text fields with word processing attributes, and buttons that connected the cards posed absolutely no problem for any of the students in my class.

The initial reactions were very positive. The students enjoyed the hypertext medium, and found that it offered them a wide variety of possibilities to compose and create. The cards were a tremendous help, because they provided the framework within which the transposing process could occur. It was essentially that, a transposing process, because the students had taken great care to design individual cards which they felt could easily be copied or replicated in HyperCard. Taken together with the concept mapping project in "science", and based on their experiences using concept maps in "literature", the students quickly and easily grasped the basic conceptual and practical fundamentals of hypermedia authoring.

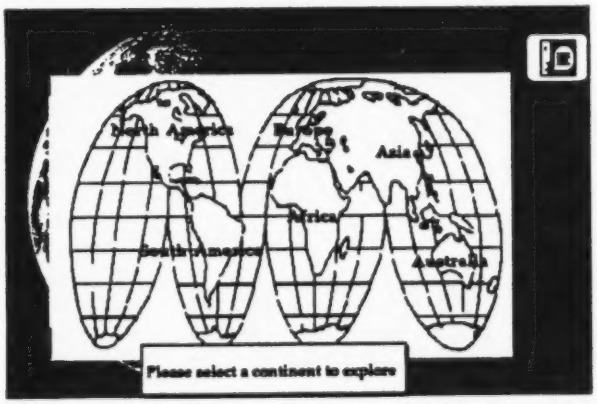
The process was very exciting, and potentially very important for the introduction and development of hypertextual materials. Representative samples of some of the student's stacks have been duplicated onto the companion diskette which accompanies this issue. These stacks have been chosen not on the basis of quality, but to illustrate the wide variety of attempts to incorporate a number of formats in the presentation of the information. Following are selected cards from some of the projects, cards which illustrate the multimodalities of design and presentation, described by the students who composed them:



This is our title card. We wanted to think of a neat graphic that could describe what our class project was all about. Tyler thought that a picture of the world would be perfect, but we couldn't draw good enough, so we went to the library to find a picture in an atlas or an encyclopedia. We found this picture in a HyperScan sample. Then with Mr. Kemp's help we edited the image to make it look as good as possible. We then copied the image into HyperCard. It was Lloyd's idea to put the world in the background so it would appear on every card of the introduction. We filled in the background so that the rest of the screen was black, and then added the text in the foreground. We created the button, and chose an icon instead of a message because we thought that it looked more professional like that. When the rest of the class saw the title card they thought it was great.


Welcome to our World
This stack, a multimedia encyclopedia of countries of the world, was designed and created by the Grade 8 students at Bishop Pocock School in Saskatoon, Saskatchewan.

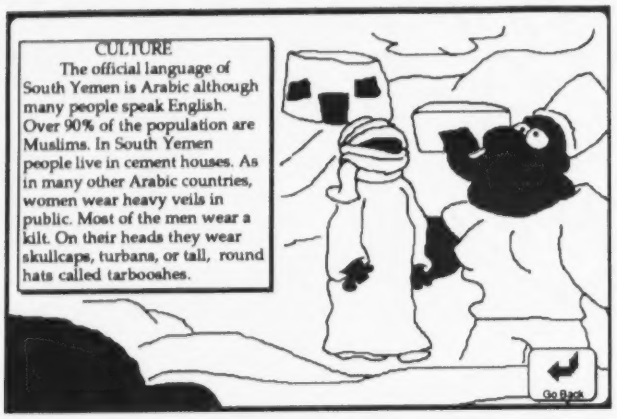
Then we made a new card (above) and created a text field to put in the credits. We chose the font, size and style of the text. Then we copied the button from the first card and pasted it into the second. We didn't link it because other groups were working on the next set of cards. We are really pleased with how it looks. (Sam, Tyler and Lloyd).



Our group made the world map card (above) which showed all of the continents. Our class had decided that these were the general areas in the world that we would choose a country from. We had to decide what type of map we wanted to use because we had several different types. We found this map in our Clip Art collection, and we thought it was perfect because it showed the whole world and there was enough room to print all of the different continent names in shadow style printing. We copied the map into the scrapbook and pasted it into HyperCard. We created a white box and placed it in behind the map so you could see it clearly. There was a lot of discussion in our group about how to label the map, or show the buttons. At first we were going to fill the continents with different patterns, but we didn't like the way it looked too messy. Then we were going to put a menu of choices on the side, but then John came up with the idea for transparent buttons over top of the continents. We liked the idea of pointing at the continent you wanted and then something would happen. We created transparent buttons, and used the button names for the continent names. We then placed all of the buttons and made the final adjustments of size. We changed the font so that it had a shadow effect just like the first group had used for the credits. We created a text field for directions in case the person using the stack did not realize that they could click on a continent. We didn't do the effects or links because we had to wait for the other groups. (Amy, Chantel, Derek)

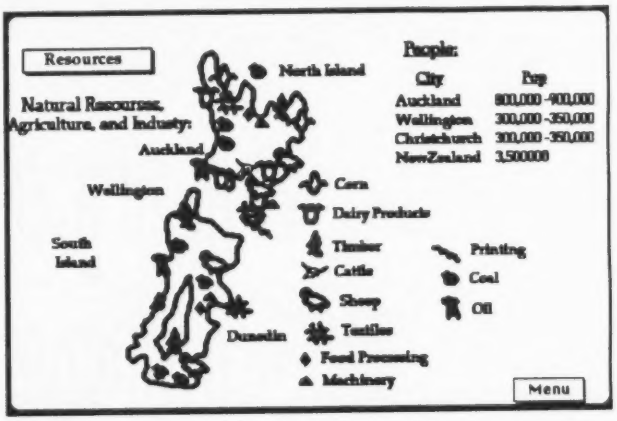
Our group did one of the continents, Asia, shown above. We found the map in the Clip Art collection, and copied it into the clipboard. Then we opened our stack and pasted the graphic into the card. We had to use our atlases to find out the correct countries to fill in with

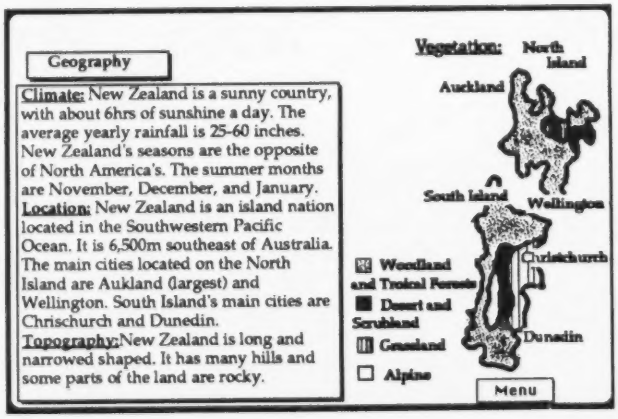
different patterns. We used the Tool box and filled in the countries that people had chosen. Then we created buttons. Amy's group told us that they were using transparent buttons so we thought that we should too, that way every card would be the same. We created our buttons, chose button info and selected transparent for the style. Then we chose the dissolve effect because we all agreed that it was the best. We moved our buttons over the countries that we had filled in, and we were done. (Shaun-dean, Clay)


CULTURE
The official language of South Yemen is Arabic although many people speak English. Over 90% of the population are Muslims. In South Yemen people live in cement houses. As in many other Arabic countries, women wear heavy veils in public. Most of the men wear a kilt. On their heads they wear skullcaps, turbans, or tall, round hats called tarbooshes.
Go Back

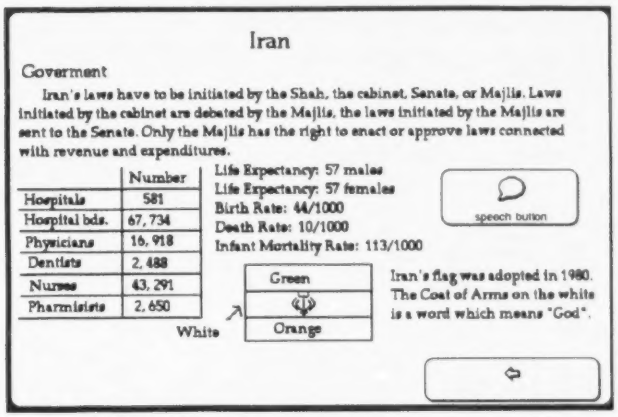
This card above, designed and created by Jared, is an outstanding example of the quality of art work that many students used to enhance their project. Jared had debated over the possibilities of describing the culture of South Yemen. In the end, he chose to express the knowledge both in textual form using a field, and graphically by hand-drawing the scenery and people around it.

The next two cards (below), designed and created by Kate Mahoney, exemplifies the variety of formats that the students attempted in order to maximize the limited amount of space available. The maps are hand drawn, and the keys of symbols were Kate's idea to combine not only the geography of New Zealand, but also the topography, natural resources, agricultural products and industry as well. The population chart in the upper right hand corner (above) was Kate's attempt to include the people of the country as resources, the resolution to an issue that bothered her for quite a while. This was an example of one of the most important, and on-going issues which confronted the students. What do I include, and where does it belong? The limited size available for one card made it a very difficult process of evaluation and synthesis. We thought about linking cards, but that only raised the issue of when would we ever stop. In the end, for the purposes of this project, we decided to limit the category to a single card.



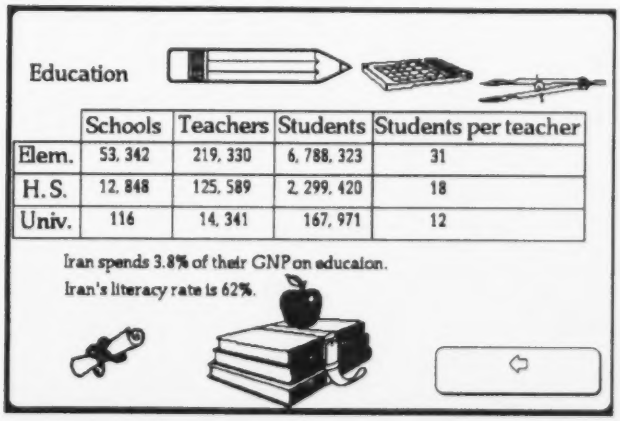

Geography
Climate: New Zealand is a sunny country, with about 6hrs of sunshine a day. The average yearly rainfall is 25-60 inches. New Zealand's seasons are the opposite of North America's. The summer months are November, December, and January.
Location: New Zealand is an island nation located in the Southwestern Pacific Ocean. It is 6,500m southeast of Australia. The main cities located on the North Island are Aukland (largest) and Wellington. South Island's main cities are Chrischurch and Dunedin.
Topography: New Zealand is long and narrowed shaped. It has many hills and some parts of the land are rocky.
Vegetation:
North Island
Auckland
South Island
Wellington
Christchurch
Dunedin
Woodland and Tropical Forests
Desert and Scrubland
Grassland
Alpine
Menu

I have included this card below from Jason's stack on Iran because it shows the use of audio in the development of the project.


Iran
Goverment
Iran's laws have to be initiated by the Shah, the cabinet, Senate, or Majlis. Laws initiated by the cabinet are debated by the Majlis, the laws initiated by the Majlis are sent to the Senate. Only the Majlis has the right to enact or approve laws connected with revenue and expenditures.
Number
Hospitals 581
Hospital bds. 67, 734
Physicians 16, 918
Dentists 2, 488
Nurses 43, 291
Pharmisists 2, 650
Life Expectancy: 57 males
Life Expectancy: 57 females
Birth Rate: 44/1000
Death Rate: 10/1000
Infant Mortality Rate: 113/1000
speech button
Green
White
Orange
Iran's flag was adopted in 1980. The Coat of Arms on the white is a word which means "God".

Clicking on the speech button results in the text being read by Jason. This was the first attempt at speech and sound in HyperCard, and proved to be the catalyst for a significant new development in the authoring process. The usage was limited in the course of this project only because we had one computer dedicated to sound and scanning.

The final card (below) was selected because it shows the synthesizing of information that was a necessary aspect of the research and development process. Abigail had recorded all of the information in the card from several different sources, collated it, and then constructed the table.


Education
Schools
Teachers
Students
Students per teacher
Elem. 53, 342 219, 330 6, 788, 323 31
H.S. 12, 848 125, 589 2, 299, 420 18
Univ. 116 14, 341 167, 971 12
Iran spends 3.8% of their GNP on educaion.
Iran's literacy rate is 62%.

Summary

The two issues which I faced, the presentation of multi-media and multi-dimensionality, were described, demonstrated and explained clearly by the concept mapping approach, the environment web project and the introduction of HyperCard

Allowing these processes to unfold simultaneously gave meaning to the thesis that conceptually and practically, concept mapping, authoring and hypertext are synonymous processes sharing an underlying philosophy: the irreducibility of knowledge, and the continual search for connectedness and inter-relatedness.

The following appendix presents several of the completed multimedia stacks. The format of presentation has been designed to graphically demonstrate the structure of the stack.

GOVERNMENT ECONOMY GEOGRAPHY
RESOURCES EDUCATION HISTORY
TRANSPORTATION CULTURE TOURIST ATTRACTIONS
Continent

TRANSPORTATION

The most important kind of transportation in Norway are railways. The trains are electric, and used mostly for hauling cargo up, down and around the many mountains. The first railway ran from Oslo to Eidsvoll, it opened in 1854. The rail industry had to blast tunnels through mountains to construct the tracks. The Norwegian government partially owns the Scandinavian Airline System, which is the main carrier of visitors into the country. Individual pilots or private companies handle flights within the country. Some planes use skis for landing in the winter or pontoons for landing on lakes in the summer. This makes landing possible at anytime of the year.

GEOGRAPHY

Norway is situated on the western side of the Scandinavian peninsula in north-eastern Europe. To Norway's north is the Arctic Ocean, to the east is Sweden, to the south is Skagerrak, and to the west is the Norwegian Sea. Some of the oldest rocks in the world are found in Norway. The land is covered with huge mountains, the average altitude is 500 metres. Norway's climate is relatively mild, considering it is so far north. Oslo, the capital, has an average temperature of -5 degrees celsius in January, and 17 degrees celsius in July. The eastern valleys receive less than 30 centimetres of rain a year, but along the coast on the west the average rainfall is 330 centimetres.

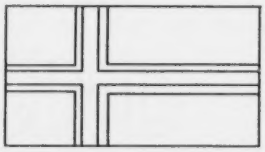
HISTORY

Even before the Vikings began to conquer, people occupied the land we now call Norway. Most of them were fishermen and hunters, rather than brave warriors. These people settled there over ten thousand years ago. These peaceful settlers are believed to have been overrun by powerful invaders. The Vikings came from all over Scandinavia, raiding the land. They were feared because of their great seafaring abilities. They were expert boatbuilders, goldsmiths, ironworkers, and artists. They were probably not the wild men they are said to have been. Some recent historians claim that many Vikings lived quietly as traders or farmers.

NORWAY

GOVERNMENT

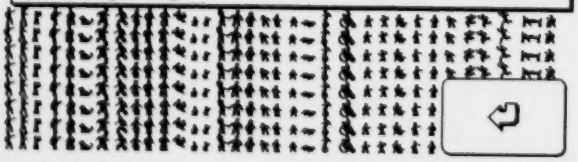
In 1960 special health laws were made in Norway. Every county in Norway has a full-time health office. Free hospital care is included in Norway's health-insurance plan. Funeral payments are also provided. Norwegian's between the ages of six and eighteen may receive dental care free of charge. The government is presently attempting to solve the problem of a shortage of doctors and other medical workers.



The national flag of Norway is a blue cross outlined by white on a red background. It was first approved for use on ships in 1821. It was accepted as the national flag in 1898.

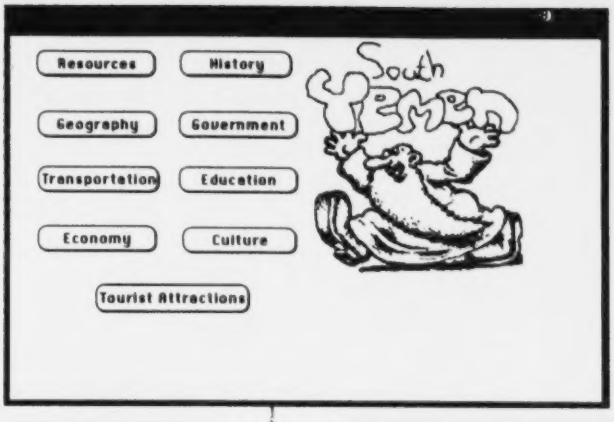
TOURIST ATTRACTIONS

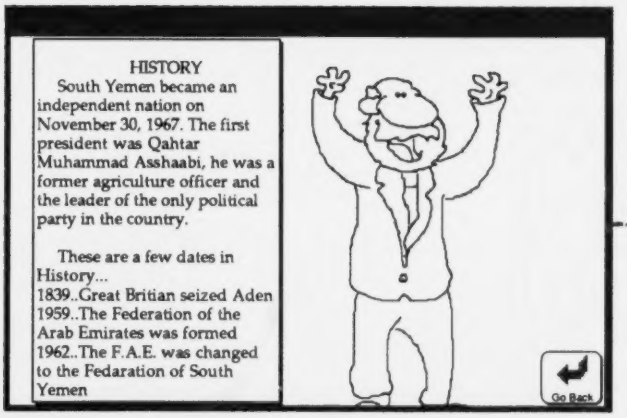
In 1985, the hotels of Norway accomodated about 6, 547,160 people, and it is estimated that 1, 933, 172 of those guests were foreigners. Income from tourism in 1985 was Kr6, 280 million. The main tourist attractions are the Arctic coast with its "midnight sun", and the beautiful scenery of the western fjord country, as well as the cities of Oslo, Bergen, and Trondheim. Another attraction is the Oslomarka, a 100, 000 hectare area situated near Oslo, with ski trails and walking paths. Due to short winter days, many trails have been lighted for night skiing.

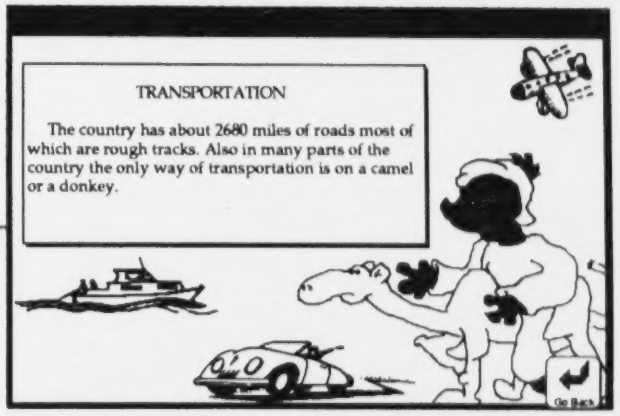


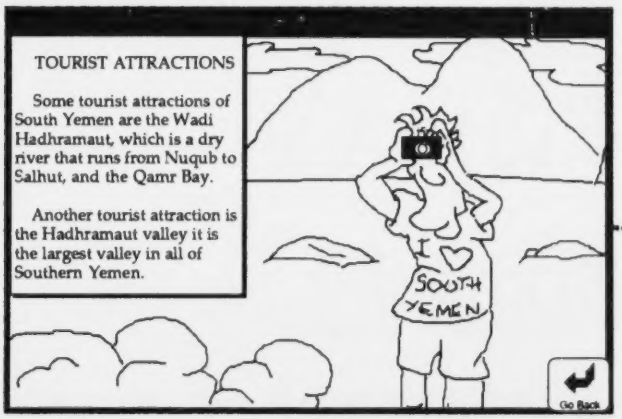
EDUCATION

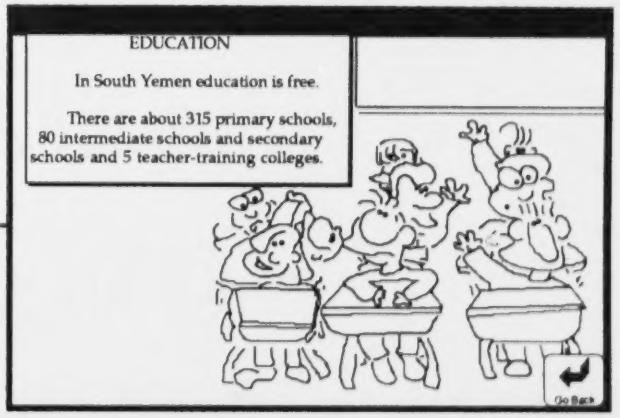
Children in Norway must attend school for nine years, minimum. Most kids start school at the age of seven. The basic school system involves six years in *barnesskole* (lower primary school) and three years in *ungdomsskole* (upper primary school). Education is free, ecept university students must purchase their own books. After primary school, students can go to high school for three years of special study. At the end of the three years students must take a very difficult exam. If the student does well enough, he or she may attend university. Teachers in Norway and university graduates are respected most highly. All students are encouraged to continue their education for as many years as possible.

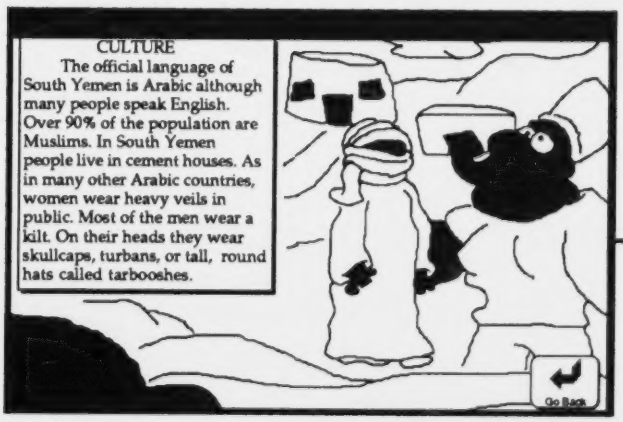

Resources
History
Geography
Government
Transportation
Education
Economy
Culture
Tourist Attractions
South Yemen

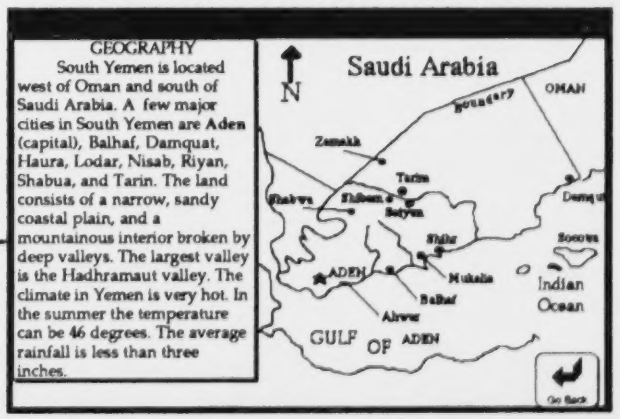

HISTORY
South Yemen became an independent nation on November 30, 1967. The first president was Qahtar Muhammad Asshaabi, he was a former agriculture officer and the leader of the only political party in the country.
These are a few dates in History...
1839..Great Britian seized Aden
1959..The Federation of the Arab Emirates was formed
1962..The F.A.E. was changed to the Fedaration of South Yemen
Go Back


TRANSPORTATION
The country has about 2680 miles of roads most of which are rough tracks. Also in many parts of the country the only way of transportation is on a camel or a donkey.
Go Back


TOURIST ATTRACTIONS
Some tourist attractions of South Yemen are the Wadi Hadhramaut, which is a dry river that runs from Nuqub to Salhut, and the Qamr Bay.
Another tourist attraction is the Hadhramaut valley it is the largest valley in all of Southern Yemen.
I ♥ SOUTH YEMEN
Go Back


EDUCATION
In South Yemen education is free.
There are about 315 primary schools, 80 intermediate schools and secondary schools and 5 teacher-training colleges.
Go Back


CULTURE
The official language of South Yemen is Arabic although many people speak English. Over 90% of the population are Muslims. In South Yemen people live in cement houses. As in many other Arabic countries, women wear heavy veils in public. Most of the men wear a kilt. On their heads they wear skullcaps, turbans, or tall, round hats called tarbooshes.
Go Back


GEOGRAPHY
South Yemen is located west of Oman and south of Saudi Arabia. A few major cities in South Yemen are Aden (capital), Balhaf, Damquat, Haura, Lodar, Nisab, Riyan, Shabua, and Tarin. The land consists of a narrow, sandy coastal plain, and a mountainous interior broken by deep valleys. The largest valley is the Hadhramaut valley. The climate in Yemen is very hot. In the summer the temperature can be 46 degrees. The average rainfall is less than three inches.
N
Saudi Arabia
OMAN
Boundary
Zamakh
Tarim
Shabwa
Seiyun
Mukalla
ADEN
Balhaf
Ahwar
Indian Ocean
GULF OF ADEN
Go Back

Transportation | Economy | History
Government | Geography | Education
Culture | Resources | Tourist Attractions

Continent

Resources

Natural Resources, Agriculture, and Industry:

People:

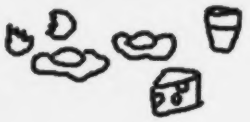
City	Pop
Auckland	800,000 -900,000
Wellington	300,000 -350,000
Christchurch	300,000 -350,000
NewZealand	3,500000

Menu

Economy

Currency: Like those of the United States and Canada, New Zealand's currency is based on a decimal system with dollars and cents. 100 cents = one dollar.

Imports and Exports: Exported food products are a major part of New Zealand's economy; Dairy Products and Eggs, Meat and Meat preperations, also wool, Forest Products and Manufactured goods.These products are all apart of New Zealand's Imports and Exports.



Menu

Government:

Flag:

Medical: The government looks after children's health needs. For children between the ages of 2-13,dental nurses provide regular dental care in school. School children in poor health are admitted to health camps.

Laws: New Zealand usually follows the precedents of English Law, and the British Privy Council act as the Final Court of Appeal for New Zealand. The hierarchy of courts dealing with cival and criminal cases includes District Courts, the High Court and the Court of Appeal.

Government: New Zealand s a memver of the British Common Wealth.The parliment is a single-chambered body. It's members are elected every three years.Four seats reserved for Maori members. The head of the political party which gets more than half of the seats of parliment becomes Prime Minister. 18 is the voting age.

Menu

Geography

Climate: New Zealand is a sunny country, with about 6hrs of sunshine a day. The average yearly rainfall is 25-60 inches. New Zealand's seasons are the opposite of North America's. The summer months are November, December, and January.

Location: New Zealand is an island nation located in the Southwestern Pacific Ocean. It is 6,500m southeast of Australia. The main cities located on the North Island are Aukland (largest) and Wellington. South Island's main cities are Chrischurch and Dunedin.

Topography: New Zealand is long and narrowed shaped. It has many hills and some parts of the land are rocky.

Vegetation:

Menu

Tourist Attraction

The Majestic Mount Cook is New Zealand's Highest mountain that is 12,349 feet tall on the South Island. This mountain and many other peaks attract many mountain climbers.

Natural Wonders Lakes, Rivers, and Waterfalls are some of the Natural Wonders in New Zealand. Most of the lakes lie in the volcanic plateau of the North Island and in glaciel valleys near the Southern Alps of the South Island. The largest lake, Lake Taupo on the North Island,covers 234 square miles and is a vacation spot.

The 5th highest waterfall is in New Zealand. Sutherland Falls tumbles 1,904 feet down a mountain.

The Waikato river on the North Island is New Zealand's longest river, flowing 264 miles.

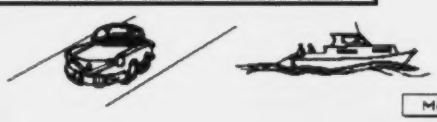
Menu

Transportation

Land: Automobiles and railroads are one of the means of transportation in New Zealand. Nearly a million New Zealanders own a car and use it very often.

Air: Air New Zealand is the country's only airline. It is owned by the government.

Water: New Zealanders use ferrries to travel over water.The ferries carry psangers, automobiles and railroad cars between the North Island nd the South Island. Auckland and Wellington are the nation's busiest seaports.



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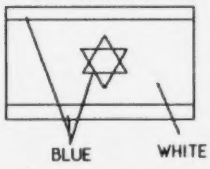
ISRAEL

Government



Every Israeli man and unmarried woman is recruited into the army at the age of 18 for 2 years and must spend 4 weeks a year in the reserves until they are 49 for men and 34 for women.

Three forths of the population are covered by hospital or clinic care . New immigrants receive 3 months free medical care , but after that have to pay taxes. The ministry of health enforces health and sanitation regulations all over the country and keeps it one of the healthiest countries.

MENU

Geography

Israel lies on the Eastern seaboard of the Mediterranean at the connecting point of Asia and Africa.

Most of the land is desert but in the North-West there is the Zelbun valley which is covered in vegetation. The only mountains are in the North. There are three bodies of water, the Gulf of Aquabain the South, the Dead Sea in the East, and Lake Kinneret. There are around 20 rivers scattered throughout Israel.

Israel has many cities, these are the only ones that are relatively large. (* This means it is the capital)

*Jerusalem- 300,000 people Tel Aviv- 400,000
Haifa-200,00

MENU

History

The first rulers of Israel were Saul, David, and caused a change in the Israeli people's beliefs and started the first commonwealth.

The life and death of Jesus, who his followers thought was the son of God and would deliver salvation to man, were big events because they started a new religion, Christianity.

World War Two was a big yet sad event for the Jews because 6,000,000 were killed by the Nazis.

MENU

Tourist Attractions

Some man made places of interest are cities like Jericho, Megiddo, and Hazor which are in ruins due to the battles between the Jews and the Romans during Biblical times. The Hebrew University, The Hadassah medical center, the Israel National Museum, and the Rockefeller Museum which are all located inJerusalem are visited lots by tourists. Yad Yashem which commemorates the 6,000,000 who were killed by Nazis in World War Two is neat to see. A memorial to J.F.K. is also popular.

Some natural places of interests are all famous biblical places are visited lots like Jesus' tomb. The Dead Sea is a very popular site because in it you cannot sink.

MENU

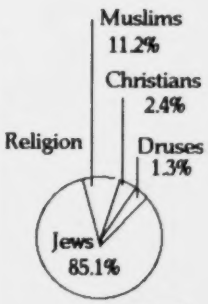
Culture

The official language of Israel is Hebrew.

The main holidays are Christmas, Hannukah, Epiphany, Easter, WhitSunday, and Accession Day.

Israel is ranked second in books published and has a large interest in books. Israelis also enjoy drama but they only have four drama groups. Over 1,000,000 people attend the theatre every season.

Sports are also becoming quite popular. The most popular ones are football, basketball, swimming, soccer, tennis, handball, volleyball, gymnastics, and fencing. None of these sports are played professional.

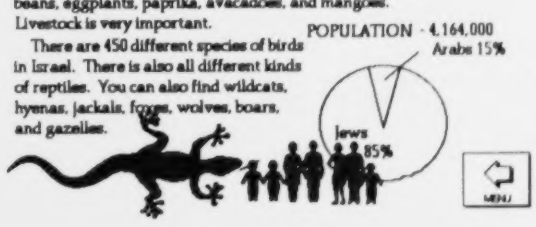


MENU

Resources

Some of the things that are farmed are grains, cotton, tobacco as well as lots of fruits and vegetables. Fruits like oranges, grapefruits, lemons, tangerines, bananas, apples, pears, grapes,figs, dates, and apricots are grown. Vegetables like lettuce, cucumbers, tomatoes, artichokes, beans, eggplants, paprika, avacadoes, and mangoes. Livestock is very important.

There are 450 different species of birds in Israel. There is also all different kinds of reptiles. You can also find wildcats, hyenas, jackals, foxes, wolves, boars, and gazelles.



MENU

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Resources | Map of Czechoslovakia

By Claudia Azucena

Continent

Tourist Attractions

The Sudetes Mountains separate northern Czechoslovakia from Poland. In winter, the snow covered peaks attract many skiers. Dosky Beach is a resort town north of Prague. Vranov adn Dyye is a picturesque village with authentic 15th Century castles and large colorful houses built during the middle ages.

Menu

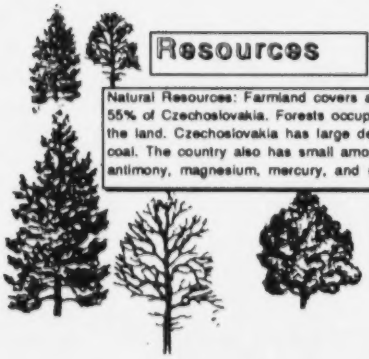
Transportation

Czechoslovakia has about 72,400 km of roads most of which are surfaced. About 14,000 km of railroad tracks link the cities and towns. The government owns and operates the country's one airline.

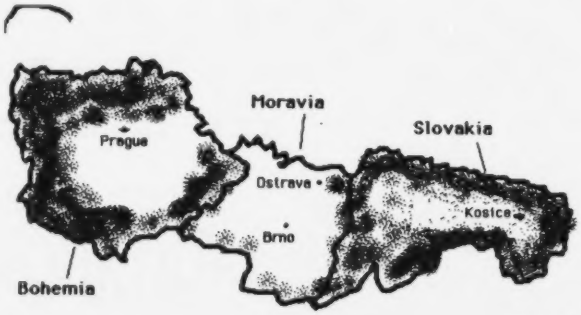
Menu

Resources

Natural Resources: Farmland covers about 55% of Czechoslovakia. Forests occupy 35% of the land. Czechoslovakia has large deposits of coal. The country also has small amounts of antimony, magnesium, mercury, and uranium.



Menu



Menu

Economy

Agricultural products: sugar, beets, potatoes, wheat, barley, rye, oats, maize (corn), hops and livestock. Industries and products: tools, machinery, vehicles, engines, armaments, wood working, chemicals, iron and steels, textiles,timber and wood products. Chief Imports: fuel and raw materials, wheat, corn, lard, butter, pork, machinery, tools and consumer goods.

Menu

CULTURE

Language:Czech, Slovak (official) also Hungarian (Magyar) German, Russian. **Religion**: Roman Catholic. **Family unit**: most Czechoslovaks own television sets and refrigerators, 5% own cars. Most Czechs live in apartmens and some live in farms. **Food and drink**: Czech cooking is similar to that of Austria and Germany, and Slovak food resembles that of Hungary. Popular foods include: Roast pork, dumplings, sauekraut and creamy pastries. Carp is the traditional Christmas dish. Czechs enjoy beer with their meals, but many Slovaks prefer wine. **Recreation**: taverns, soccer games, motion pictures , ballet concerts, and operas are the most common forms of recreation. Both Czechs and Slovaks only wear their folk costumes on special festivals.

Menu

Menu

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Transportation
Education
Culture
Tourist Attractions
Geography
Economy
History

BY: KATE MAHONEY& MELISSA BYUN

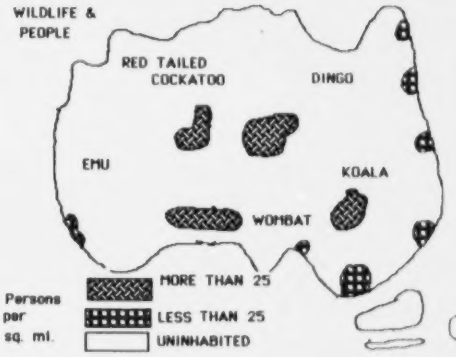
Continent

TRANSPORTATION

LAND: Automobiles are the main forms of transportation in Australia. Nearly every family in Australia owns a car and use it.
AIR: Australia has 2 major domestic airlines.Trans Australia airlines and Ansett Airlines of Australia. The air transportation in Australia is important in the outback. The Royal Flying Doctor sevices flies emergency medical help to all areas except to the Northern Territory
WATER:Ships are another means of transportation. They usually haul most of Australia's inter-city frieght. The ships also carry large amounts of minerals.

Menu

WILDLIFE & PEOPLE



Next Card

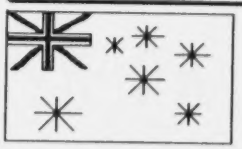
EDUCATION

SCHOOLS: Each state has it's own educational system. Primary and secondary shools are free, children most go to school until the age of 14-16 depending on individual state laws. The government provides special education for mentally handicapped and bright children.
UNIVERSITY: Each state capital has at least one university. Colleges of advanced education offer courses in agriculture and various professional fields. The government provides a large number of scholarships to assist students at all types of universities and colleges.

Menu

GOVERNMENT

MILITARY: The armed forces of Australia is all voluntary. Australia's armed forces consists of 3 services that make up a United Command called the Australian Defence Force.
FEDERAL GOVERMENT: The Federal Goverment of Australia is officially headed by a government, who represents the queen. Each Australian state of Australia elects 10 senators, and each mainland territory elects 2.
LAWS: The Federal Courts of Australia decides constitutional questions. It also acts as the nations court of final appeals. Other federal courts deal with bankruptcy cases, family law, industrial disputes and violations of federal law.



Menu

HISTORY

PEOPLE:Native tribesmen called Aborigenies lived in Australia before the white man came. The Portugese were the first Europeans to reach Australia.
EVENTS:In 1851 an event happened that changed Australia's history. It was the discovery of gold.

GOLD

Menu

AGRICULTURE

Farm products make up about four-fifths of Australia's exports. Australia is the leading sheepraising country in the world. It has about 43 million sheep or about 11 times as many sheep as people. Wheat is Australia's second most important agricultural product. Australia has more than 20 million beef cattle and 4 million dairy cattle. Sugar cane grows along the last coast of Queensland and northern new south wales. Fruits raised in Australia ranged from tropical pineapples and mangoes to varieties grows in temperate zones like apples, strawberries.

MENU

Resources

Iran's agriculture brings in 9 billion dollars and provides jobs for 36% of Iran's workers. Twelve per cent of the land can be farmed on because of severe water shortage. Wheat and barley are grown on 75% of the cultivated land. Iran's crops are corn, cotton, dates, and other fruits, lentils, nuts, rice, sugar beets, tea, and tobacco products. Cattle, sheep, and goats provide Iran with it's dairy products.

Persian 46%	Arab 2%
Azerbaijani 17%	Bakhtiari 2%
Kurd 9%	Turkmen 2%
Gilaki 5%	Other 7%
Luri 4%	
Manzandaran 4%	
Baluchi 2%	

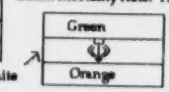
Iran

Goverment

Iran's laws have to be initiated by the Shah, the cabinet, Senate, or Majlis. Laws initiated by the cabinet are debated by the Majlis, the laws initiated by the Majlis are sent to the Senate. Only the Majlis has the right to enact or approve laws connected with revenue and expenditures.

	Number
Hospitals	581
Hospital bds.	67, 734
Physicians	16, 918
Dentists	2, 488
Nurses	43, 291
Pharmisists	2, 650

Life Expectancy: 57 males
Life Expectancy: 57 females
Birth Rate: 44/1000
Death Rate: 10/1000
Infant Mortality Rate: 113/1000

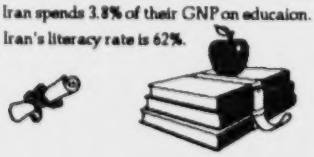


Iran's flag was adopted in 1980. The Coat of Arms on the white is a word which means "God".

Education

	Schools	Teachers	Students	Students per teacher
Elem.	53, 342	219, 330	6, 788, 323	31
H. S.	12, 848	125, 589	2, 299, 420	18
Univ.	116	14, 341	167, 971	12

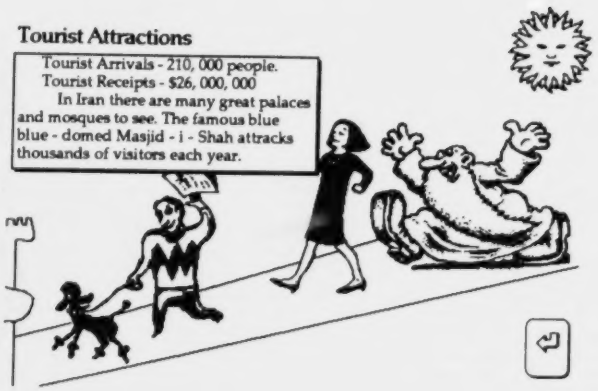
Iran spends 3.8% of their GNP on educaion.
Iran's literacy rate is 62%.



Tourist Attractions

Tourist Arrivals - 210, 000 people.
Tourist Receipts - $26, 000, 000

In Iran there are many great palaces and mosques to see. The famous blue blue - domed Masjid - i - Shah attracks thousands of visitors each year.



Geography

Iran is southwest of Asia, northeast of the Arabic penninsula and it faces Russia. The Gulf of Oman is to the south and Iraq and Turkey border Iran.

Cities	Population
Tehran	6, 043, 000
Mashad	1, 464, 000
Isfahan	987, 000
Tabriz	971, 000
Shiraz	848, 000
Ahwaz	580, 000
Bakhtaran	561, 000
Qom	543, 000
Karaj	527, 000
Orumiyeh	301, 000
Abadan	294, 000
Rasht	291, 000
Kerman	257, 000

Iran's interior highlands are surrounded by mountains. Lots of salt deserts cover the area but there are lots of forest areas also.

Heavy snows cover the mountain peaks in Iran's winters. In the summer it rains about 12 inches each year. Also in the summer large winds usually cause sand and dust storms. It gets very hot also.

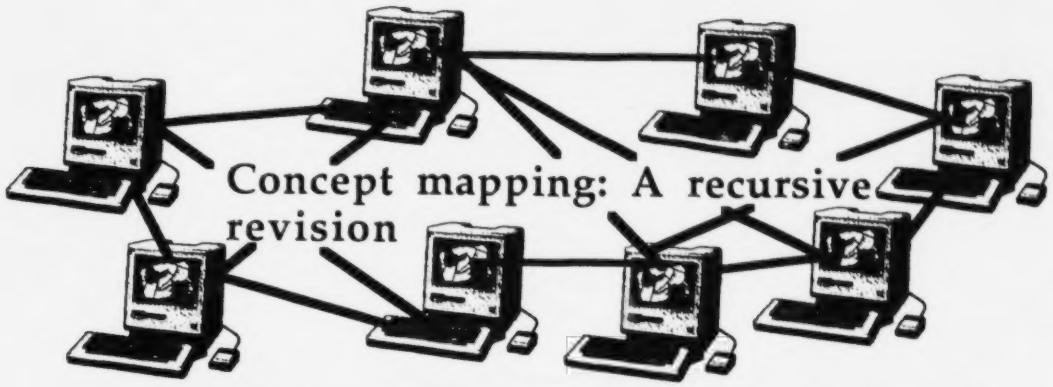
Transportation

Iran's poor transportation is a major economic problem. Privately owned Iranian Airways, company flies within Iran's neighbouring countries. International airlines flyto other lands.

Iran's first railroad was in 1892 and Iran made more railroads in the 1920's, only to be completed in 1938. Washington owns 2000 miles of Iran's railroads.

Automobiles travel on 17, 000 miles of paved roads and camels, donkeys, mules, and horses travel on unpaved roads.

Iran owns few merchant ships so Russian ships carry most of their imports and exports on the Caspian Sea.



Concept mapping: A recursive revision

Abstract: Elaborating on the concept mapping approach for the construction and negotiation of meaning, this article features iconic representations and group discussions of the meaning of HyperCard for Grade 8 students at Bishop Pocock Elementary School.

In attempting to relate the inherent traits of multimedia and multidimensions to hypermedia authoring, I had turned to concept mapping as a means or agency to describe and demonstrate. Now, my interest in concept mapping turned more towards the summative. In so doing, I was guided by the work of Kenneth Bruffee (1986), who described a "social constructivist" stance to the construction of meaning.

> The social constructionist assumes that there is no such thing as a universal foundation, ground, framework, or structure of knowledge. There is only an agreement, a consensus arrived at for the time being by communities of knowledgeable peers. Concepts, ideas, theories, the world, reality, and facts are all language constructs generated by knowledge communities and used by them to maintain community coherence (p. 776)

In my stance as researcher, and teacher, and learner, I was keenly interested in ways and means of describing a sensitive interpretation of the meaning of HyperCard to my students. I was guided also by the writings of Jerome Bruner (1986) who described meaning making as "interpersonal negotiation, what we can agree upon, or at least accept as a working basis for seeking agreement about the concept at hand" (p. 122). These became, then, the framework within which I sought to describe the meaning of the phenomenon that was authoring in HyperCard.

Our first step was to generate the terms that would serve as the elements in the description process. We "brainstormed" a list of 46 terms which the students provided and I copied down. The only criteria was that there had to be a connection to HyperCard. After all of the possibilities had been offered, I copied the list for each randomly chosen group of three students.

The next step was to be the construction of the concept map along the lines of the environment web. However, a quote from Jonassen (1988), which had attracted my interest earlier, seemed to be a way or means of making the concept mapping process

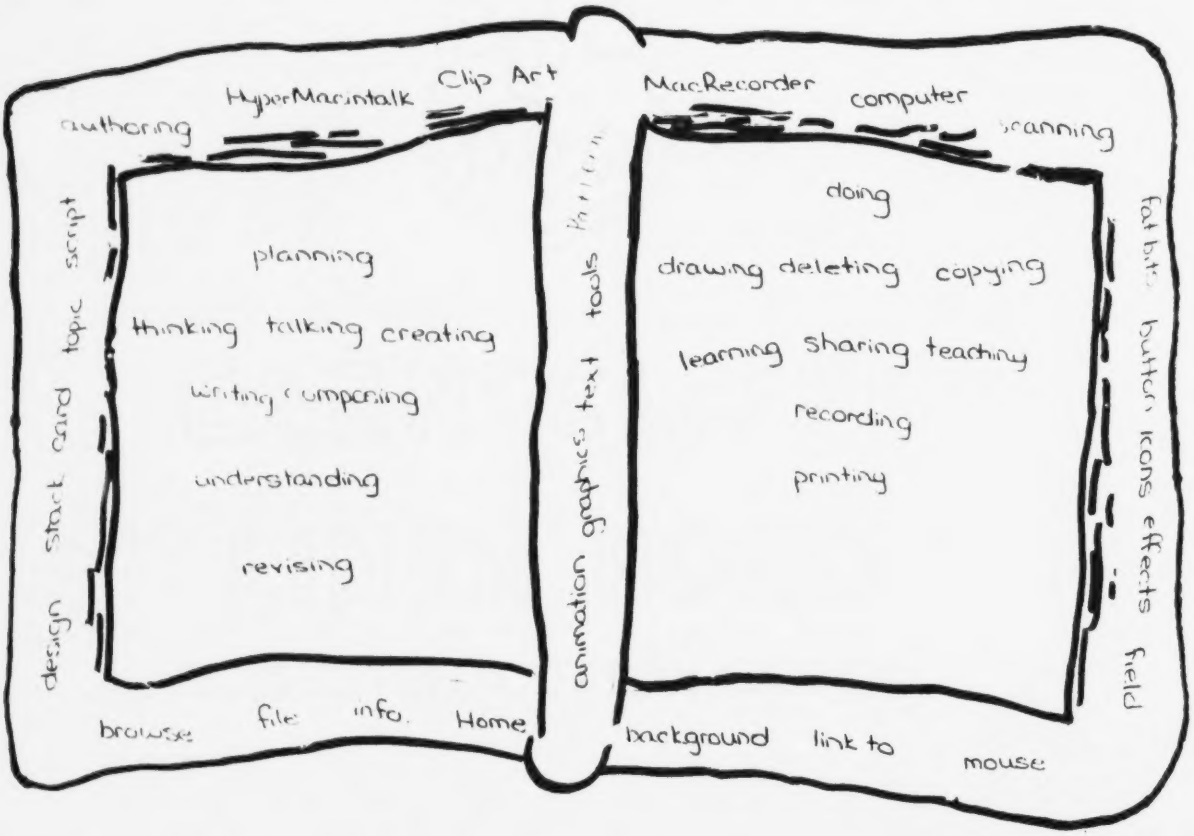
more recursive, self-referential, experiential, iconic.

> What is most distinct about hypertext is its ability to represent in its own structure and presentation, the structure of knowledge that it is attempting to convey. (Jonassen, 1988, p. 14)

Elaborating on the concept mapping approach to the construction and negotiation of meaning, but incorporating the notion of self-referentiality, my idea was that instead of showing the elements connected by propositions or linkages, the very shape of the construct should be the proposition. It should describe that which it was describing.

Thus my directions to the students were simple: Fill in the blank, **HyperCard is like a _____.**

The results follow in the format in which they were recorded, a dialogue between the groups of students and myself.



Group: Jared, Curtis D., Derek

The medium: Okay, HyperCard is like a book, what is there about a book that suggests to you that it is like HyperCard?

Jared: Well, when you first look at a book all you see is the cover, you don't know too much about what's inside the book.

Then if you start reading the book you start to learn more about it, know more about the plot or the story. It was the same when we started working in HyperCard, we didn't know very much, but now it's like we're almost finished the book because now we know a lot more about what it can do.

The medium: Is it a special kind of book or does that represent any kind of book?

Derek: Well it's any kind of book, because some of us did stories, but some of us did sort of like encyclopedias, so it's any kind of book, and like there are pages in a book and HyperCard has cards.

Curtis: It's got pictures sometimes, and graphics in HyperCard is sort of like the same thing. And in a book there's lots of information, facts and stuff, and it's the same in HyperCard because it has lots of stuff in it too.

The medium: But in a book you usually go from page to page in order.

Derek: Yeah, in HyperCard it's different because you can go to any page you want, or when you're writing you can take them to a lot of different pages.

Jared: But you can do the same in a book, because like my stack was a choose your own adventure and that's the same thing in a book.

The medium: What about special things that HyperCard can do, like sound and animation, can that be done in a book?

Curtis: Yeah, I saw a book that had batteries and it had sound, with different little buttons, and I saw one once that had a little piano in it, so sound is the same.

The medium: What about animation?

Derek: Yeah, like if you flip the pages really fast it looks like it moves, you know like those books you can make.

Jared: We built the spine with animation, graphics, text, tools and patterns in there because those are the main things you use and the spine holds the whole book together and so these are some of the strongest points of the book, of HyperCard, like the spine is the strongest part of the book.

Derek: This side here is the planning side: you plan it out, you think it out, and then there's writing and composing and so after you do that you understand more and then you're revising any time you want to.

The medium: Okay, what about the other page?

Jared: This is like the actual doing part on the computer, and after doing all these things (pointing to drawing, deleting, copying), you learn and share stuff with the teacher

Curtis: Or other people too!

Jared: Yeah, you record your sound and then you can print it all out on paper. This part here (pointing to lower left) is the design, like your stack and cards, and design your topic too,

like sometimes when I'm working I am designing too.

Derek: And these things, HyperMacintalk, Clip Art and MacRecorder are the three basic things you can choose to use in your stack, they're programs by themselves that you can use, and over here (pointing to right side) are the things that you can use in HyperCard.

Jared: Like fat bits, icons effects.

The medium: Is there separate categories for these things around the outside or do they all fit together?

Derek: They all are in HyperCard, but they're sort of grouped together because they're all together.

Curtis: Yeah, kind of like they (the outside elements) help what's inside.

Derek: It's like the cover is made up of all these things, but then the really important stuff is inside, either planning or doing, whatever page you're on, and the book is open to show both pages because sometimes you do both things.

The medium: Thank you, that was very interesting!

Group: Amy, Stephanie, Kate

The medium: What is there about our world that makes you think about HyperCard?

Amy: The world is made up of different places, like these are all the places you can go in HyperCard, so we

thought of HyperCard as being the world.

The medium: But there's lots of things that are made up of different things, why the world?

Kate: It's full of life and living, things grow and develop, there's lots of life, and when we were using HyperCard, our stacks kind of grew, they got bigger.

Stephanie: Yeah, and our knowledge grew, we learned a whole bunch more about the countries we were working on.

Amy: The people in the world make it special, there's no other place that has life, has people, it's people that make the world special, so in HyperCard, it's the people that make it special.

Stephanie: The world changes too, like we thought about what we talked about in Science, you know, how things change and what happens because of erosion, and that drifting, you know.

Amy: Continental drift, like when the continents split up and move and crash into one another, well in HyperCard, these things move and they're always changing, they're bits of one big thing, like with Pangaea.

Kate: And it's all connected, right? Everything on Earth is all connected, so we wanted to show that so we chose the world because everything on here is all connected.

The medium: Interesting. What about the groups, are they important?

Kate: This group here (pointing to the top continent), these are all the HyperCard things, these are things that you can do with the computer, things like creating, and drawing, and even talking because lots of times in the lab there was lots of talking and people asking for help and stuff, or maybe even talking about other things too!

The medium: No doubt! What about this one (pointing to the center continent)?

Stephanie: These are the things that you can use to help make your stack, these are the pieces of HyperCard, you use these when you're putting your stack together.

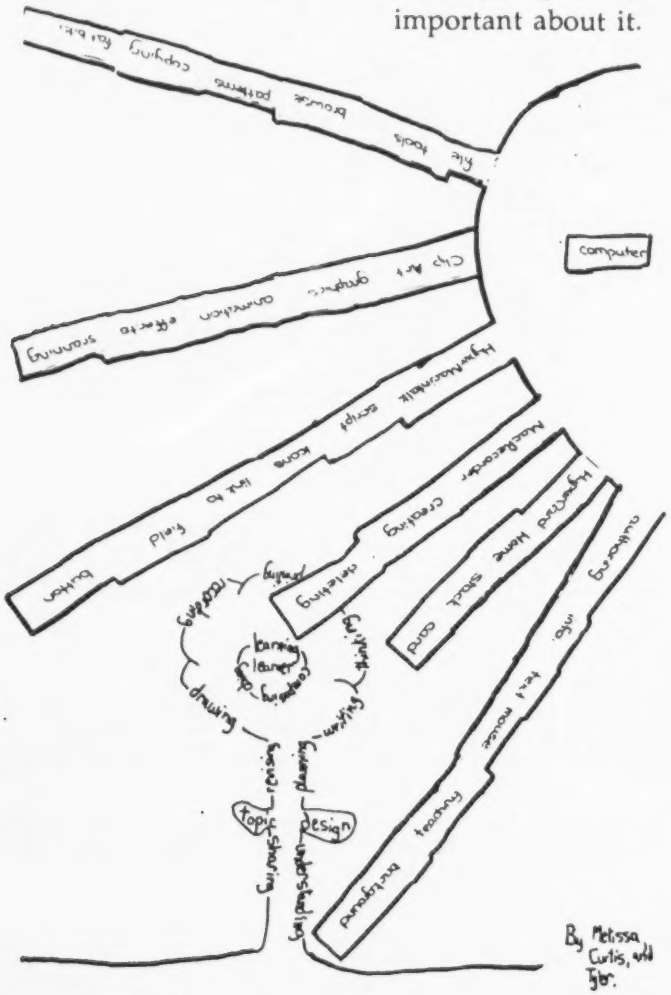
Amy: This continent here (the left side), they make your stack better, you use them when you put together a stack to make it better, like fat bits for drawing, but these are computer things because you can't scan stuff and use the mouse except on the computer. And this one on the other side, it's the other side of this one, like it's supposed to be wrapped around, so it is joined with the one on the other side, and that's because all these go together.

Stephanie: This one at the bottom is the doing stuff, like the things you have to do to make a good stack, but it doesn't go around to join on to the top, they're not connected, except they used to be, all these used to be connected together, but now they're split up and moving, but they can join back together again, they don't stay apart.

The medium: Where did your idea come from?

Stephanie: Well, we've been talking a lot about life on earth, and environmental stuff, and it just sort of popped into our heads, and we all really liked it.

Kate: Well this connected stuff is just like HyperCard, because after we had made all of our cards we had to join them together, so that's connecting, right? HyperCard is making connections, sort of like when you go from Canada to Europe by jet, you could go from one card in Hyper Card to another, that's what was really important about it.



Group: Curtis H., Tyler, Melissa

Tyler: Okay, the sun is like a computer, and it's like the power source, and then all these rays of sunshine they have all the different options that you can do, and they're fueling the flower which is the learner, just like the rays of the sun help things to grow. And the learner, he or she understands and this helps the flower grow tall.

The medium: So you've combined two symbols, a sun and a flower. Now what is there that's special about the sun that makes you think of HyperCard, or the computer?

Melissa: The sun gives the flower energy, and the computer gave us energy to learn and to write and do stuff, it provided options.

Tyler: It did things quickly and more efficiently.

The medium: Okay, and what about the symbol of the learner as a flower, what are the qualities of a flower that made you think of a learner?

Curtis: It grows, and we grew in what we knew.

Tyler: It breathes and stuff.

Melissa: It interacts with all of the things around it, and like when we were in the lab we would do the same thing, and that would help us grow. We grew in more knowledge and that helps you learn.

The medium: So the sun helps provide some things for the flower. Now is that a one way relationship? Does the sun only provide things for the flower, and so does the computer only provide things for the learner?

Tyler: The flower uses the sun, like it uses and makes use of the sun, but then it interacts with the other things, you know, like giving off carbon dioxide, doesn't it?

Curtis: And it's part of the food chain too.

The medium: So are you saying that the learner doesn't affect the computer?

Melissa: The learner just uses the computer, we don't change it, like you know, make it better, or do different things.

Curtis: It changes you.

Tyler: The flower uses what the sun gives off, the heat and the light.

The medium: Alright, let's talk about the flower. You've got the center of the flower as being made up of the learner, and learning, doing, and composing.

Tyler: Because the person that is the flower, they're learning things about HyperCard, and this is what you do on the computer.

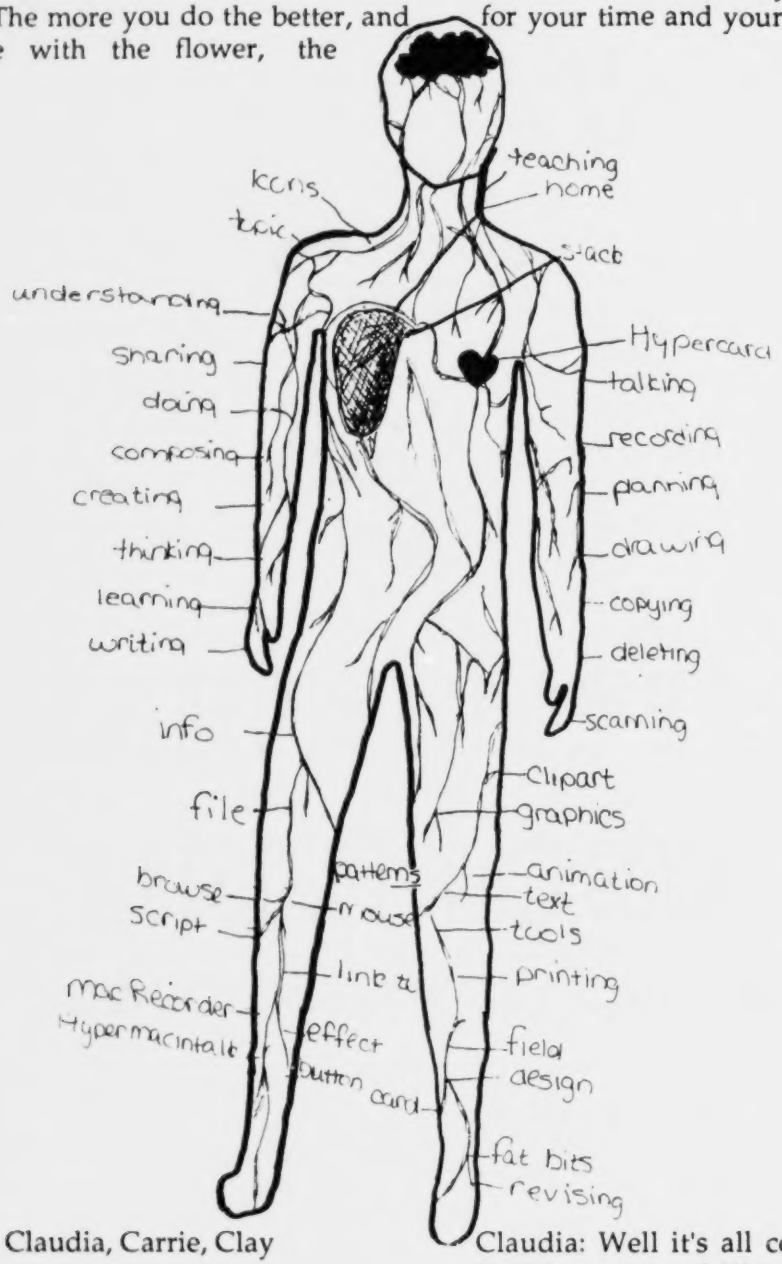
Melissa: And the petals are what happens after you're doing and composing, these are the things that you do with what the computer gives you. These happen because of learning, doing, and composing, all the action.

Curtis: The stem is made up of things that support what you do, like sharing is piggy-backing off other people's ideas, and then you're always planning and revising and stuff, and the stem moves the nutrients from the soil up into the lower, and so does sharing and planning and revising move things into your stack so that it gets better.

The medium: So these are the means by which you do these things, the action stuff.

Tyler: The more you do the better, and so like with the flower, the stronger the stem the better the flower will stand up.

The medium: Thank you very much for your time and your insights!



Group: Claudia, Carrie, Clay

The medium: HyperCard is like a human body. What is there that's special that relates it to HyperCard?

Claudia: Well it's all connected and it functions sort of like a human body because it's all made up of pieces that work together.

Carrie: And the brain is the computer because if that doesn't work then the whole thing doesn't work, sort of like it controls everything.

Clay: And the heart pumps blood, and you can't live without it because it gives oxygen to the cells, and so it's like HyperCard because HyperCard gave us energy and it sort of kept us going.

Claudia: Each limb has a special purpose, and it's the same on our picture, each limb has a special purpose. The arms are all of the 'ing' things that we did to put our stacks together, and the legs have all of the computer things.

Clay: It grows and like the human body it grows and gets more mature, and then with us, we were learning, that sort of growth, in HyperCard, and other things.

Carrie: We learned new things and added them in, and then soon we needed all of them to make our stacks work properly, so like a baby learns to walk and use it's legs and stuff, and so after you can't do without them or it's not as good.

Clay: And we wanted to show like with exercise you get stronger and can make your body do even more, and so when we used some things in HyperCard, like, it got better.

The medium: Does that body represent the learner?

Carrie: Yeah, it represents the learner, but also the relationship between the learner and the computer, it could be any learner.

Clay: And there could be other bodies with different stuff inside, like another learner could just have PowerPoint inside instead of HyperCard but then these things (pointing to the right leg), these would be different. And like the heart wouldn't be as strong, and the legs and arms would be weak, especially the arm, because PowerPoint isn't as good.

Claudia: Your arms are really important, and so we wanted to show that these things in HyperCard are really important, like they're vital to the body. These veins and arteries are all the things that you do when you use HyperCard, and like the heart pumps blood, well HyperCard gives us all these things.

The medium: What about the lung?

Clay: It's very important because it sort of connects the inside of the body to the outside, you know, like when we breathe.

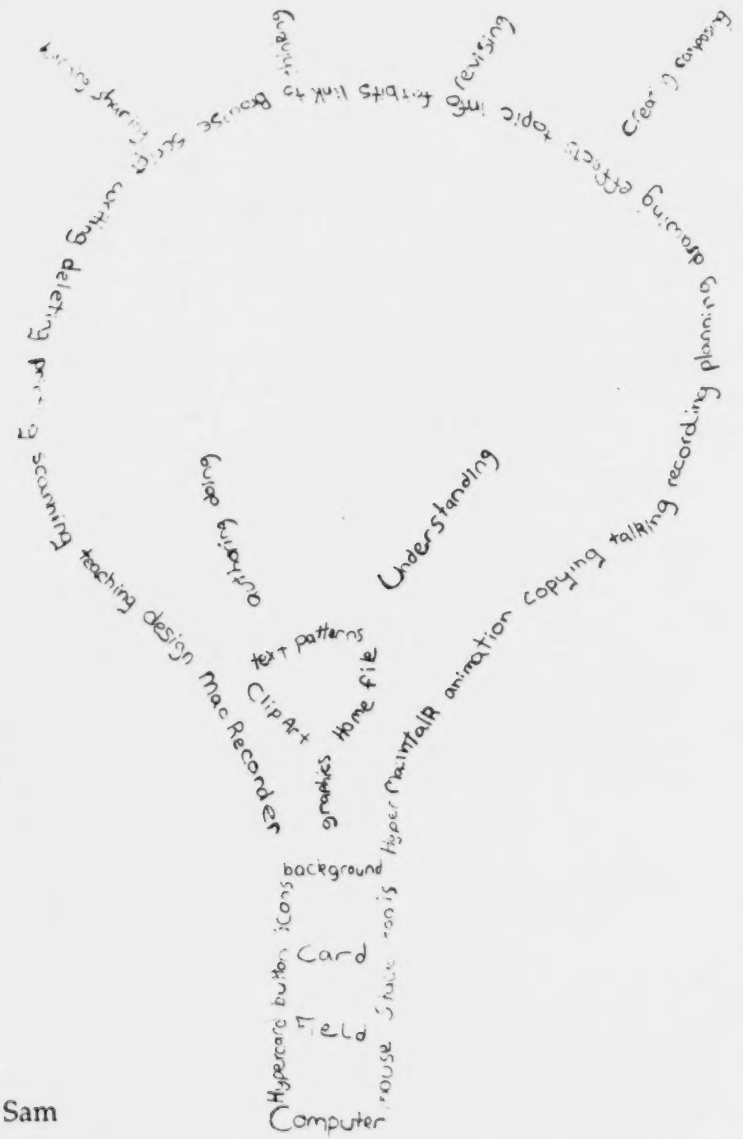
Carrie: If you didn't have lungs then you can't work properly because you don't get enough air, and so in this drawing we said that we kept needing home because that sort of connected us to other things like Clip Art and stuff.

The medium: So the stack, the lung, that takes in all of the information?

Claudia: Yeah and it gives it back too, like when we breathe out, well when we were in HyperCard sometimes our stacks gave us new ideas and information and stuff, and then we would give that information out in the lab. We were always sharing and copying ideas and asking people stuff.

Clay: Yeah, that was really important, like, this person isn't alone, there's lots of other people too, just like a city or town, or even the lab. And even though they have the same basic parts, like our picture, they're all unique. No two people are the same.

Claudia: Well, I guess we just wanted to try and show that HyperCard was like a living thing, it grew, and had special parts that all did different things but worked together, so this is what we came up with.



The medium: What are the special qualities of a lightbulb that make it similar to a lightbulb?

Ryan: This thing here, the element I think it's called, it lights up the whole bulb, it's the screw in part of the lightbulb plus the wire inside, it lights

up the whole lightbulb, and so these are the most important things that make up HyperCard.

Michael: This screw in part is a connection, it connects the light bulb to the socket and that's how the electricity gets in there, so it's a connection. The main purpose of the light bulb is to make light, and this is what makes it happen, and you need these things to make HyperCard happen.

Sam: These things on the outside are kind of like the glass part, like it holds the lightbulb together, and gives it it's shape and stuff, but it doesn't block the light, you can see the light glowing inside, but you need the glass otherwise the bulb doesn't work, so you need these things on the outside or the lightbulb won't work.

Michael: It brings it all together, it helps it do what it does.

Sam: These things on the outside are sort of what's given off when HyperCard works, like learning, sharing, thinking, revising, creating and copying, that's what happens when we were working in HyperCard.

The medium: Why is teaching not out there too?

Michael: It could be, because sometimes in the lab we helped each other, and so we were teaching, right?

Ryan: Yeah, like John helped me out lots, but I didn't want it out there because teaching isn't just something that's given off by HyperCard, it's always there, like, we always helped each other and you were always helping us, so it was a really important thing and so I thought it sort of made the whole thing happen.

Michael: Authoring and doing and understanding could have been outside too, but we wanted to show that the center wire gave off something, like that's where the light came from, so we put those inside the lightbulb so you know where all these things come from, like the outside ones come from the middle stuff too.

The medium: Interesting, now what about the whole idea of a lightbulb, what is there about a lightbulb?

Ryan: Bright ideas! Like you know, when someone gets a bright idea the light goes on, so we wanted to show that with HyperCard you get lots of good ideas.

Michael: The light, kind of lights up the darkness, so everything is clearer, and with HyperCard we could see things clearly, you know, when we were working on our stacks for the countries, then we got to know them better, and then HyperCard helped us share those ideas and all those facts and helped others to see clearly.

Ryan: For me the light bulb was cool because of the ideas thing, and everytime I worked in HyperCard I got lots of neat ideas about different things. Sometimes the ideas about what to do would just kind off pop into my head, and I'd think about it, and then I'd do it, but then later I'd get more ideas. I always got lots of neat ideas when I was doing HyperCard.

Sam: Yeah, me too, sometimes I had so many ideas that I couldn't remember them all!

The medium: Was the shape of the lightbulb important, because there's all different kinds of light bulbs and they're all different shapes?

Ryan: Well, it's sort of important because it's round, and sometimes we'd go round and round and not get anywhere in particular (laughing)!

Sam: For me, the only important thing about the shape was that everyone thinks that this is a lightbulb shape, so they know it's a lightbulb, and maybe if we had made a long skinny one then maybe they wouldn't get it...

The medium: That's right, the first time I saw your project I went, "Oh, a lightbulb", I knew right away!

Michael: Way to go, Mr. Kemp, you were the test because if you didn't get it then we'd have to change it (laughing)!

Ryan: Bright idea, huh? Get it, bright idea, lightbulb! (more immature laughing!)

The medium: Okay, alright, very funny, now the whole world, or at least the 5 people that are going to read this will know that I had a bunch of clowns on my hands for 10 months and I did my best, so I bet they pass me just because I put up with your jokes for all that time!

Sam: We deserve something too! (more immature laughing!)

The medium: Okay, alright, let's focus! Now, where were we, oh yes, I was thinking about the lightbulb and what makes it work, electricity, right? So, what makes your lightbulb work, what makes HyperCard go?

Ryan: Well because in HyperCard it's something that needs ideas, it's a place where you can create, like drawing and writing and stuff, so I guess for me I make it work, the person using it makes it work.

Michael: Yeah, but you just can't work in HyperCard with no ideas, so maybe for me it's knowledge, like all the stuff we know, all the facts and information and stuff, that's what makes it work, the knowledge we have.

The medium: So I guess your light bulb would only be 25 watts, eh Mikey? Hahaha (at this point there were several comments which were undecipherable. I attribute this to recorder error!)

Ryan: Yeah, I think Mikey's right, it's the person, but it's your imagination and ideas, because no one had the same ideas, like in our group we all came up with different cards for almost the same kind of stuff, it was our own ideas that made them all different.

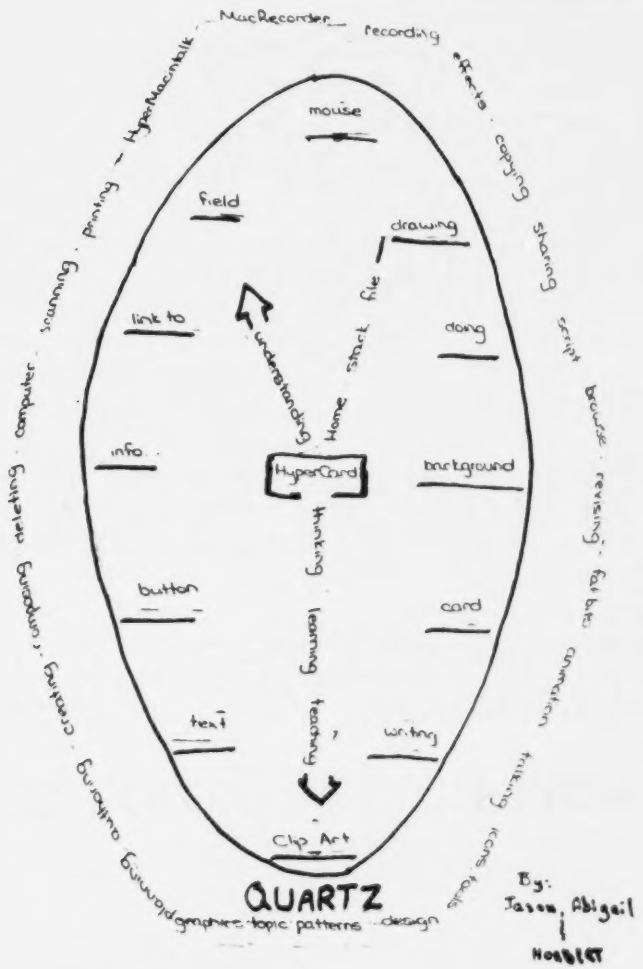
Sam: But I don't know, I think me and my ideas are the same, you know what I mean, so I guess for me there's no difference, so I think it's both.

Michael: Wow, that's deep Sam!

Ryan: Yeah Sam, that's something like Mr. Kemp would say, Mikey's right, that's deep!

The medium: But isn't Sam right, though, I mean, what's the difference between you the person and what you think and what you do?

Michael: That's what I liked about HyperCard so much was that even though I was using all this information and stuff, and it was somebody else's ideas and words, right, when I got into HyperCard and started working, they became mine because I'm the only one who could do it that way. So it was mine, and sometimes I was HyperCard.



Group: Abigail, Norbert, Jason

The medium: Okay, what is there about a clock that makes you think about HyperCard?

Abigail: Well, like a clock shows how when times goes by we learn more and more.

Jason: HyperCard saves your work, it stores your ideas and keeps them, and then when you get to go back later, it tells you what you've done.

Abigail: It gives off information too, like it shows the time, and in HyperCard it gives of information, like all the stuff we found out about our countries.

Norbert: It kind of repeats itself too, but like every time it goes around it's different, not the things on the clock, you know, the time is the same but it's different because it's a different time and different things have happened, like, it's not the same any more. I don't know!

The medium: No wait, that's right, I think I understand what you're trying to say. Are you saying that even though the face of the clock shows the same time every 24 hours, that what's happening at that time is different?

Norbert: Yeah, like it keeps going around and around and so it sort of looks like it doesn't change but every time it goes around nothing is the same anymore, it's always changing but it doesn't look like it.

The medium: And is HyperCard like that?

Norbert: Yes, because every time I start up HyperCard, it looks the same, like it doesn't change, you know the tools and the fields and buttons and stuff, it looks the same, but it's different because I've changed a little bit and so have my ideas, and so my stack is different even though HyperCard is the same. Like with the clock, every time it goes past the 12 it's a different time and so things are different, but it's the same 12 that it was the last time.

Amy: Yeah, like my stack was always changing too, and sometimes I would even go back and change stuff that I'd already finished, and I'd change it when I got new ideas to make it better.

Jason: I didn't think about that, but I guess I sort of agree, I just thought about how clocks are so important, you know how everyone always needs them. They organize everything, you know, schedules and stuff and everything runs off a clock, well I thought HyperCard was like that because it helped me to organize my stuff, my ideas.

The medium: Interesting, lots of good ideas here, okay, so what about the clock, Jason, describe the clock for me.

Jason: Well the outside is the boundary of the clock, it's sort of like what the clock is, and these things sort of what HyperCard is, all this stuff. These are all the things you do in HyperCard, like printing, scanning, and browse, and graphics, all those things, that's what HyperCard is.

The medium: Interesting, now what about the hands of the clock, why is the little hand understanding?

Jason: Because it moves the slowest, and so sometimes it takes a long time to understand something.

The medium: And you've got two other hands there.

Amy: This hand here, Home stack and file, that's the second hand, and like it goes by really fast, like when HyperCard saves your stuff for you, saves your stack, and it's really quick using Home and stack and file.

Norbert: This is the minute hand, and it's the next fastest, and so we thought that these were the things that were the next fastest, you know like thinking of ideas and stuff, and learning about HyperCard and our countries and what we're doing, that was faster than understanding.

The medium: And the points around the clock?

Jason: These are all the things that you do with a card, when you're thinking and learning, and so like this is the face of the clock, right, and this is the card in HyperCard, and so when we're learning and thinking and stuff, this is what we use to make our cards.

The medium: So the face of the clock is what you go through in making a card?

Norbert: Yeah, but there's lots of things that could go on the face but we chose these because we couldn't decide which ones belonged on the face of the clock and which ones belonged around the outside.

Jason: That's like when I said that this was what HyperCard was all about, you know, it's what HyperCard is, and so you could take these ones here and move them into here, and maybe switch them around and that would still be okay.

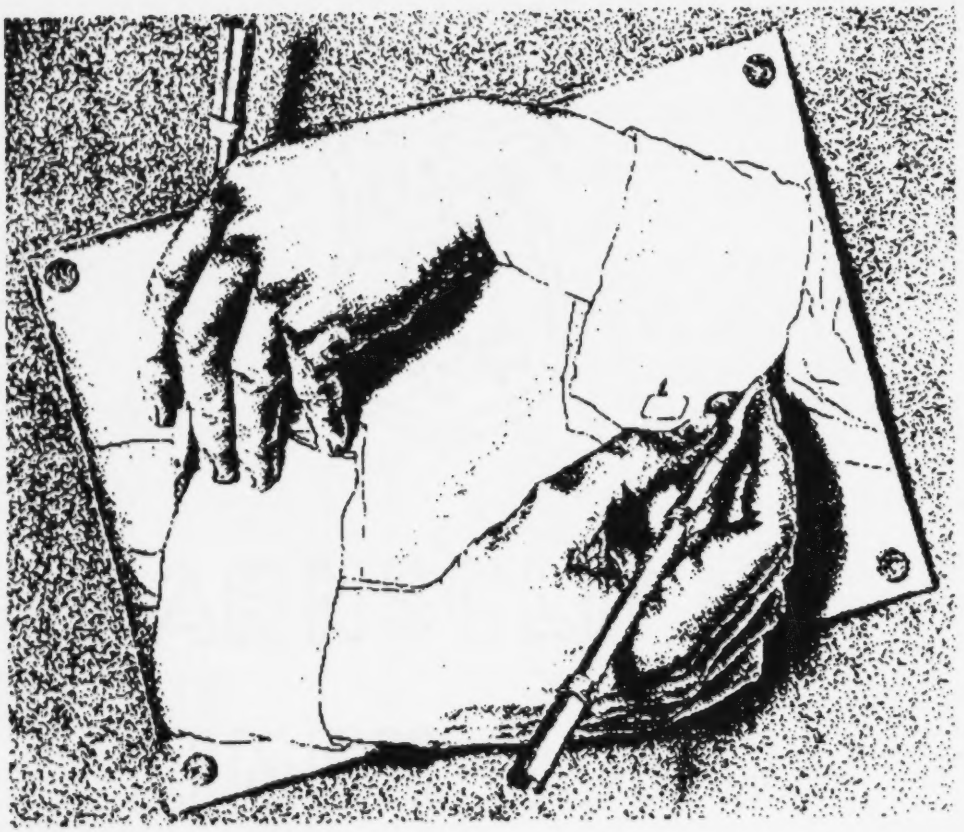
Summary

It has been proposed that concept mapping and hypertext authoring are activities which fall under the general rubric of social constructivism. This consensual process of meaning-making is based upon "interpersonal negotiation, what we can agree upon, or at least accept as a working basis for seeking agreement about the concept at hand" (Bruner, 1986, p. 122). The products of this process were presented and described in their entirety, with no editing or alteration of the narrative process.

Concept mapping holds great promise as a means for describing the nature of a hypermedia authoring environment, and also for the description of the nature of the authoring experience itself. This recursive revision was meant to try and bring the full meaning of the student's understanding of HyperCard into a more self-referential, iconic, recursive framework.

The medium

An inquiry into the nature of the authoring experience in a computing medium



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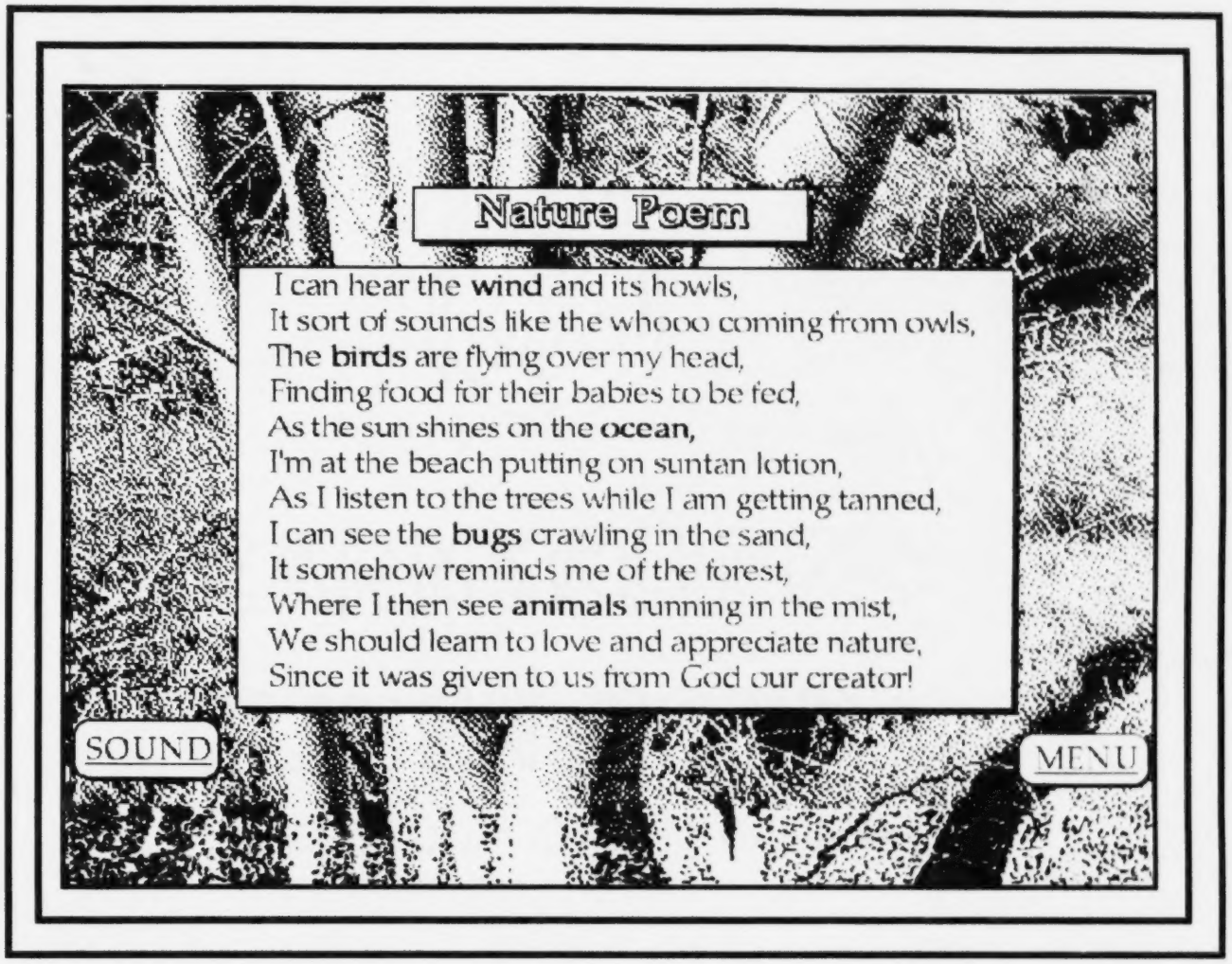
Nature Poem
I can hear the **wind** and its howls,
It sort of sounds like the whooo coming from owls,
The **birds** are flying over my head,
Finding food for their babies to be fed,
As the sun shines on the **ocean,**
I'm at the beach putting on suntan lotion,
As I listen to the trees while I am getting tanned,
I can see the **bugs** crawling in the sand,
It somehow reminds me of the forest,
Where I then see **animals** running in the mist,
We should learn to love and appreciate nature,
Since it was given to us from God our creator!
SOUND
MENU

In this issue: ***The ecology of hypermedia***

October, 1992 Volume 2, Number 3

The medium

An inquiry into the nature of the authoring experience in a computing medium

October, 1992 Volume 2, Number 3

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The aim of ***The Medium*** is to provide a forum for discussion and debate concerning the nature of the authoring experience in a computing medium. It is the contention of the author that computer-based, multimedia authoring environments constitute a qualitatively different experience as an authoring medium. It is to the description and interpretation of the nature of this authoring experience that this journal, as an on-going narrative of research conducted as partial fulfillment for the degree of Doctor of philosophy, is dedicated.

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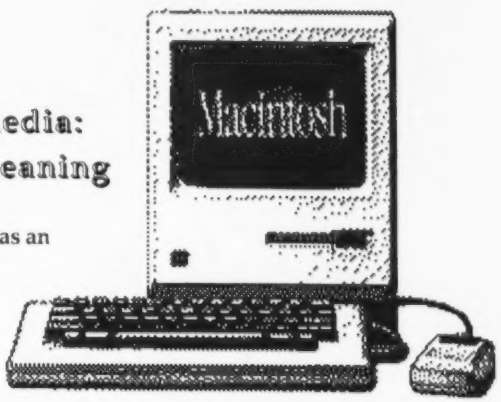
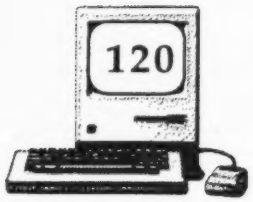
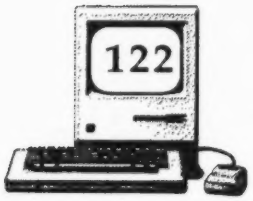




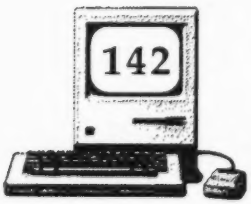
The ecology of hypermedia: Spinning the web of meaning

A discussion on the nature of hypermedia as an authoring environment



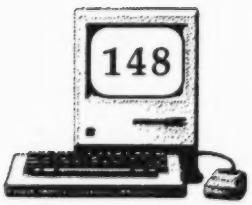
Hypermedia authoring: Understanding the process

This article will offer a synthesis of the findings of current research in terms of the issues relating to authoring in this new medium, and complement and supplement the findings with dialogue from interviews with elementary and post-secondary students.



Editor as author as publisher: A dialogue

The medium, in discussion with Mr. Stephen Kemp, takes a retrospective look at the dynamics of the authoring and publishing process.



Student compositions in the medium of HyperCard

This article presents the compositions of the students from Bishop Pocock Elementary School using the computer-based, interactive multimedia, authoring environment, HyperCard.

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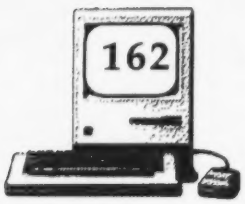
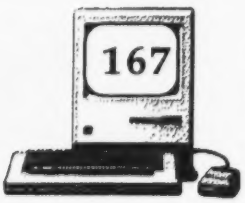


Software Review: HyperCard

John McGrath and Jared Peace reveiw the multimedia authoring application, HyperCard. Included in the review is a description of the authoring process, and examples of the kinds of products available from the program.



Software Review: MacRecorder

Abigail Dy, who used this sound generation and editing application frequently in her compositions, provides an overview of an exciting enhancement to multimedia authoring.

In our next issue:

The nature of the authoring experience in a computing medium

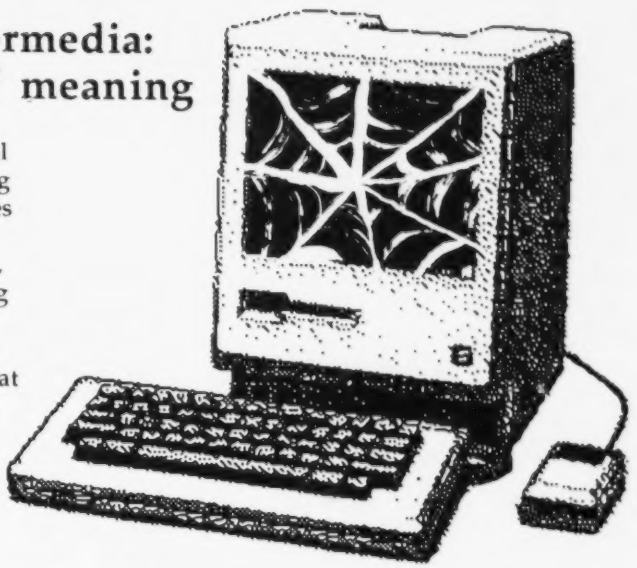
Concept mapping: The meaning of our journey

The Tao of research: Re-visited

To Be is to Do is to Know: Complementarity as education as complementarity

The ecology of hypermedia: Spinning the web of meaning

The metaphor suggested by the ecological model is that of a web, in which anything that affects one strand of the web vibrates throughout the whole (Marilyn Cooper, 1986, p. 370). The ecology of hypermedia, therefore, is a continual process of looking for, creating, and maintaining, a sense of coherence and unity. It is a system (Ervin Laszlo, 1972) of "living spaces and all that is within them" (Stan Rowe, 1990, p.46).



The word "ecology" is derived from the Greek word "oikos" which means house or home. Therefore, a literal translation of ecology is "the knowledge of home", or "home wisdom". As such, it invites study of the world's living spaces and all that is within them. (Stan Rowe, Home Place: Essays on Ecology, 1990, p. 46)

The living space that is the focus of our attention in this issue of *The medium* (itself a living space) is that of a computer-based, multi-dimensional, authoring environment, hypermedia. As such, this is not the traditional concern of ecologists, whose interest usually lie in the biotic, or living world, of the plants and animals of our planet Earth.

But I am an educator, and I too am interested in these "living spaces", in the particular context of the whole that is Education. I am interested in the biotic, the fellow teachers and learners and researchers who comprise this dynamic environment of Being and Becoming. But with the incessant demands and potentials of new technologies, this is no longer a living space just for the biotic. The computer, one aspect of the abiotic element in Education, represents a critically important aspect of the nature of our new living space that we must explore. As in the world at large, all elements of life, both biotic and abiotic, are connected. Each has their own unique aspects, but both represent the complementarity of our Earth, mutually internested. And so it is with the biotic and abiotic aspects of education. They too, while each uniquely described, constitute the complementarity of education. That is why this issue of *The medium* inquires into the nature of this educational "living space and all that is within it".

The very use of the term ecology, denotes the particular emphasis with which this inquiry will unfold. As Marilyn Cooper (1986) writes, "the metaphor [for writing]

suggested by the ecological model is that of a web, in which anything that affects one strand of the web vibrates throughout the whole" (p. 370). This will very much be a holistic process, an inquiry that seeks to come to a more full understanding of the systems inherent, and explicit in the relationships between all of the constituent elements in education. As Ervin Laszlo (1972) writes

> The "new scientist" concentrates on structure on all levels of magnitude and complexity, and fits detail into its general framework. He discerns relationships and situations, not atomistic facts and events. By this method he can understand a lot more about a great many things that the rigorous specialist, although his understanding is somewhat more general and approximate. Yet some knowledge of connected complexity is preferable even to a more detailed knowledge of atomized simplicity, if it is connected complexity with which we are surrounded in nature and of which we ourselves are a part. If this is the case, to have an adequate grasp of reality we must look at things as systems, with properties and structures of their own. Systems of various kinds can then be compared, their relationships within still larger systems defined, and a general context established. (p. 13)

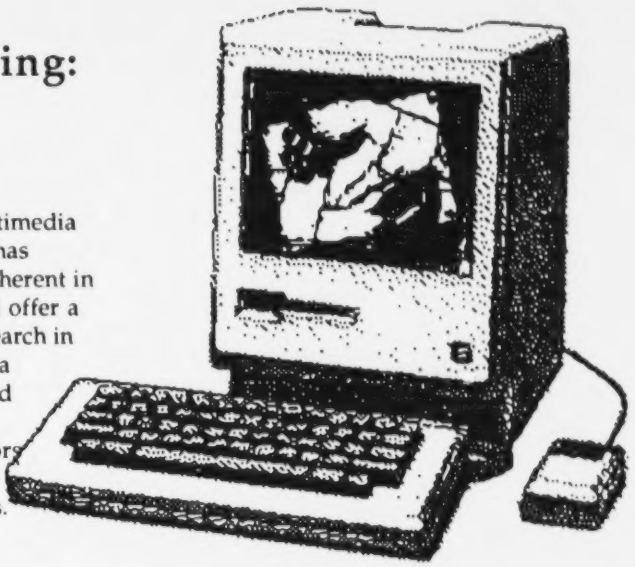
Notice that I used the present tense of the term, writes, to refer to an insight that is 20 years old. This web is three dimensional. It has width and breadth and depth. It is longitudinal, it is evolutionary. It alone is the master of Time.

Our journey therefore will be one of looking for those relationships and situations, to describe and elaborate, not to reduce and atomize. The underlying perspective will be that of an all-encompassing unity, a coherence in and among all aspects of this journal, and the situations which it describes. I am looking for connections, to illustrate and describe how the context that is hypermedia is, and how it relates to the other contexts with which it was intimately connected: the students, and myself. All of the articles in this issue reflect each other, while at the same time hopefully outwardly re-defining the horizons of our understanding.

The spider's web in the computer screen which represents the theme of this issue, is not meant to convey the message that the future, or even present for that matter, of technology is dead! Far from it. The medium that is hypermedia, and the teaching and learning and researching contexts which impinge upon it, are very much dynamic, and evolutionary. This is not a static medium. It is my sincere hope that between each and every one of the lines of this journal, you, the observer, as I was in my roles as teacher and learner and researcher, will feel that energy, that unbridled enthusiasm which characterized so much of this experience.

The ecology of hypermedia, therefore, is iconic. It is self-referential, it is experiential, it is dynamic, and open. It is a medium of growth and evolution. It is the medium of this issue of *The medium*.

Hypermedia authoring: Understanding the process



Abstract: The advent of powerful, multimedia authoring environments for computers has necessitated a re-vision of the issues inherent in the authoring process. This article will offer a synthesis of the findings of current research in terms of issues relating to authoring in a multimedia authoring environment, and elaborate the research findings with dialogue from interviews with educators and post-secondary Education students enrolled in an Educational Media class.

The advent of powerful, multimedia authoring environments for computers has necessitated a re-vision of the nature of the authoring process. Authoring as a medium of expression, a means of articulation, is undergoing change.

A medium can be variously described as an environment, a tool, or an agency or means for effecting change. The messages which emanate from the medium are the processes which are both implicit and explicit in the creation and maintenance of the environment. As the nature of the medium changes, so too must the messages which emanate from that medium. In this case, the medium is authoring, and the change is one from a paper-based, linear, sequential, two-dimensional medium to that of a computer-based, multi-dimensional, multi-modal, multimedia authoring environment.

Jerome Harste (1988), described the authoring cycle (p. 10), which has served as a paradigm to assist in the understanding of the authoring process in a paper medium. I would like to propose a paradigm which describes the authoring process based upon their work, but accounts for the multimodal opportunities for expression in a technological context.

It is to the description of the messages from this new medium, both from a review of the literature standpoint complemented by a dialogue with elementary and post secondary students, and an interpretation of the nature of those messages, that this article is directed.

medium

The medium is computer-based, multimedia authoring. In so describing the process by which discrete elements such as text, graphics, sound, animation and video

are combined into nodes, and then linked together into a coherent whole, I do so following the lead of John Slatin (1990), who describes the process as

> the more comprehensive activity called "authoring". Authoring may involve not only the composition of text but also screen layout and other things that fall under the general rubric of interface design; it may also involve a certain amount of programming. Perhaps most importantly, authoring involves the creation and management of links between nodes. (p. 876)

Authoring in the hypermedia context involves the construction of discrete elements which are then linked together to form a coherent whole. The elements, or nodes, are composed of a variety of media encompassing a full spectrum of visual and auditory possibilities.

Elements: Hypermedia

Hypermedia is an extension of the term "text" to include other components such as video, illustrations, diagrams, voice and animation, and computer graphics (Horn, 1990, p. 12). In the medium of HyperCard 2.0, a commercially produced authoring environment from Apple Computer Inc., graphics may be created from within the program itself by the means of various painting tools very similar to those available in other art programs such as MacPaint, MacDraw and SuperPaint. In addition, graphics may also be incorporated from collections of commercially prepared graphics known as Clip Art, and then edited using the graphics capabilities of HyperCard. Sound is available through a number of different applications such as HyperMacintalk, which emulates human speech through a phonetically-based approach, or MacRecorder, which digitizes sound and provides for sound creation and editing functions. These sounds can then be incorporated directly into the HyperCard compositions. Animation is possible within HyperCard by creating a series of nodes which differ slightly in the presentation of the graphics, thus replicating the crude animation created by rapidly flipping through a series of cards. Other forms of information transfer include the integration of productions from other applications programs running under the "umbrella" of HyperCard, and the incorporation of video and scanned images.

The attributes: "hyper"

The term Hyper-, as a prefix, denotes the concepts of above, beyond, or surpassing. It is in this context, therefore, that the terms hypermedia and hypertext have been coined to exemplify an authoring environment in which the media and the text itself, can be transformed into something else, something that goes above and beyond our conceptualization of what technology, media, and the authoring process can do, represent, or can become.

Interactive multimedia authoring is the process of navigating to islands of articulation in a sea of expression. **Empowered** with this opportunity to literally "chart your

own course", the author can express or articulate their knowing in

> an **enabling** rather than a directive environment. Hypermedia offers new opportunities to diverge from the linear path; to juxtapose text, animation and sound; to turn the technology back on itself as an aid in producing new interpretations of the content. (Marchionini, 1988, p. 9)

Slatin (1990), eloquently describes this dynamism, a recursive, evolutionary process that knows horizons, but no boundaries.

> One implication of this is that the hyperdocument "grows" by a process of accretion, whereas the conventional document tends to have been winnowed out of a larger mass of material. HyperCard is, therefore, an inclusive medium. The end product of the authoring process, the hyperdocument, is not a closed system, like a book; it is rather an **open and dynamic system**. (p. 876)

While not without it's problems and limitations, the concept of **personalization** is one that is fundamental to a hyper-environment. The old adage that more is not necessarily better certainly applies to the issue of the degree and type of learner control, but Jonassen (1988a) argues strongly in favor of individualizing the learning process, stating that

> In hypertext, readers are not constrained by the subject matter structure or by the author's organization of the text. Since an individual's knowledge structure is unique, based upon his or her own set of experiences and abilities, the ways that individuals prefer to access, interact with, and interrelate information is also distinct. (p. 14)

Perhaps synonymous with the term, "hyper-", the term, "**multi**-" is one that is often used to describe the attributes of such a learning and teaching environment. Multimedia, of course, relates to the variety of visual and auditory media that can be incorporated into a composition, and goes hand in hand with "multisensory", for a hyper-environment is often a steady barrage upon the senses. Similarly, multi-dimensional is often acknowledged as a critical attribute, particularly in comparison with the dual dimensionality of the paper medium.

> Print, like all types of media, has both strengths and weaknesses. Primarily, the weaknesses of print are its: (1) use of a single sensory channel (vision); (2) reliance on a fixed, linear sequence of presentation; (3) lack of interactivity; (4) absence of built -in editing tools to create new intellectual works; and (5) restriction to single-user mode only. It should be apparent that these weaknesses of print are the strengths of multimedia computer systems. Depending on its underlying technological infra-structure, a multimedia computer system can provide the user with a multisensory, nonlinear, highly interactive, edit-oriented, and multi-user environment. (Bailey, 1990, p. 35)

Younggren (1988), also describes this multivariate process, the ability to "learn and access information that truly incorporates the idea of n-dimensions - the ability to move in any direction that seems appropriate at hand" (p. 78).

The tenor and tone of every article about hypermedia suggests activity, engagement, action and doing. It is very much a dynamic medium, but with the ever-present potential of being lost in a limitless expanse of information, unable to move ahead and not knowing where and why you arrived at your present place, the need for a sense of **coherence and unity** is paramount. Hypertext walks a thin line between order and chaos, for on the one hand it promises to bring greater clarity and a unified vision over bodies of information, yet at the same time, it contains the possibilities of further fractionalizing knowledge (Byles, 1988, p. 60). The task then becomes one of creating, or maintaining a coherent whole.

> Hypertext and hypermedia systems are of such signal importance precisely because they permit us to assemble large collections of discrete materials composed in different media, and to link them usefully and powerfully together in a variety of ways, without destroying the integrity of the individual components, the nodes of the system. (Slatin, 1988, p. 127)

The attributes of this new context for creating are many and varied. From the perspective of the author, the medium of hypertext has been described as "empowering, enabling, open, dynamic, multifaceted, and personalized", offering the potential for articulation and expression in a medium that facilitates the construction of personal meaning-making.

While the writing process still connotes the paper medium, "authoring" now implies not only a elementally different process, but a qualitatively different one as well. In a paper medium, the nature of the medium is linear, and generally sequential. It is cumbersome to attempt to inject some form of digression from the normal flow of thoughts and words, except through the use of footnotes or references. The mechanical aspect of turning pages is likewise prohibitive, and frustration and annoyance usually result from constantly flipping back and forth, or only glancing down to the bottom of the page for elaboration of the topic and then trying to return to the previous place while maintaining the logical thought progression. With the exception of the "Choose your own adventure" type formats, books are generally planned and organized to present information in a linear, sequential, logical format.

In a hypermedium, the qualitative differences come from the attributes of the medium itself. Designing and planning in three dimensions, considering the best form of media to use to describe the point or topic, even selecting what information belongs on what node and how it relates to all of the other nodes, is a qualitatively different "writing" experience. It is entirely non-sequential, in fact, it can be almost totally random, creating nodes as related ideas emerge spontaneously,

and simply allowing the flow of ideas to continue and then worrying about the elaboration, form or type of relatedness later. Sound, video and animation offer exciting new possibilities to demonstrate and describe. Authoring in this context is both a quantitatively and qualitatively different experience than authoring in a paper medium.

medium/messages

Jerome Harste, Kathy Short and Carolyn Burke (1988), in their work Creating classrooms for authors, have proposed the authoring cycle presented below, as describing the process of authoring in a paper medium.

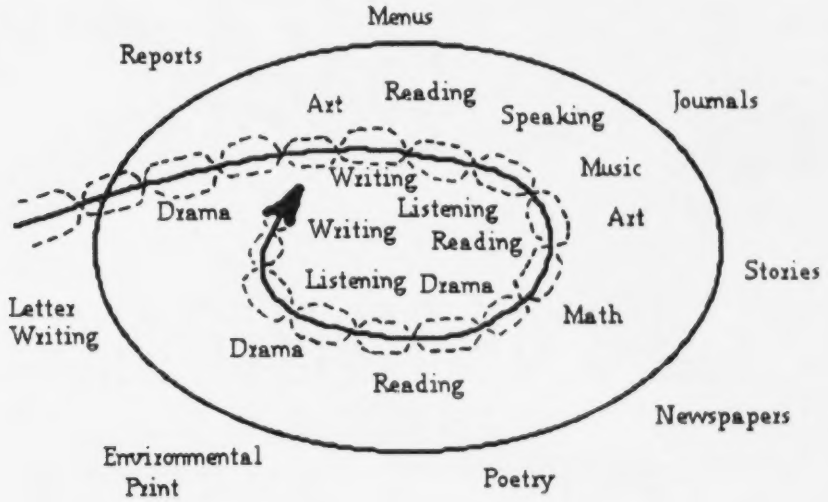


Figure 1: medium/messages: The authoring cycle (Harste, Short, & Burke, 1988, p. 10)

Learners bring to the cycle a stock of life experiences that are the basis for engaging in personally meaningful communicative events. The oval that surrounds the cycle represents the situational context **[the medium]** in which all instances of authoring are embedded, and the activities listed outside the oval represent the multitude of culture-specific contexts in which literacy events can be enacted.

The path of the cycle crisscrosses between the alternate communication systems of language, art, drama, music and math. This is a recognition that both authoring and learning are multimodal processes and that authors shift stances from reader to writer to artist to speaker and so on.

As authors move between communication systems they are able to expand the range of meanings they can express. A final aspect of the cycle depicted in this diagram is the regenerative nature of authoring. Neither authoring nor learning is seen as having an end point. When meanings are expressed or created, they

> metaphorically become fuel for the next cycle. (Harste, Short, & Burke, 1988, p. 10)

Based upon the paradigm as described above, I would like to propose the following model as representative of the authoring cycle in a computer-based, authoring environment:

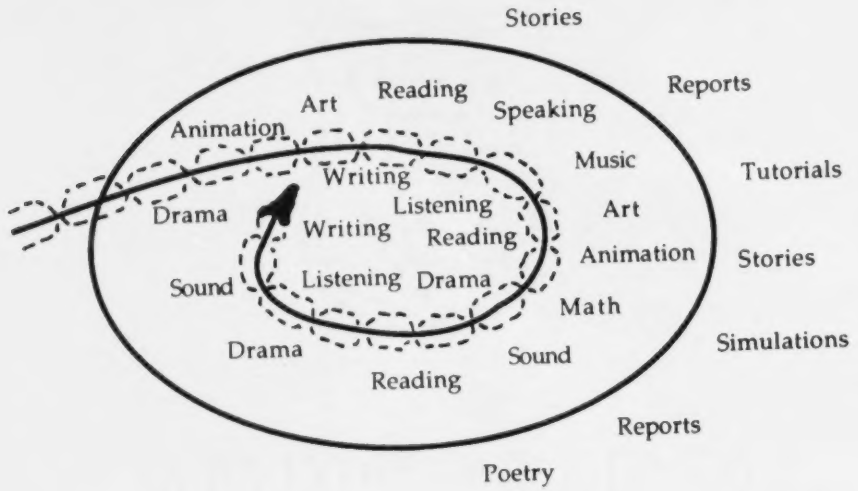


Figure 2: medium/messages: A hypermedia interpretation

Given the restraints of time and limitations of both hard- and soft-ware, the range of applications as noted above was impressive. Note that the multi-modality referred to by Harste, Short and Burke has changed to reflect the nature of the medium. To those modalities already listed can now be added those specific to the new medium: sound and animation. In this respect, technology has but complemented the variety of life experiences which the students brought to the composing task, an amplification and elaboration rather than a muting and constricting.

Once again, the oval represents the situational context, or medium, that is hypertext. The activities listed outside the oval represent the variety of uses which HyperCard was employed by the post-secondary students in an Educational Media class at the University of Saskatchewan, and the Grade 8 students at Bishop Pocock Elementary School.

medium/messages/meaning

A review of the recent literature concerning hypertext and hypermedia, in combination with the comments from 28 post-secondary students in the College of Education at the University of Saskatchewan and my grade 8 students, suggests that the authoring process in such a context is a daunting endeavor. I have chosen to concentrate this discussion on but one aspect of the issues surrounding hypermedia, that being the authoring

process (see Locatis, Letourneau, & Banvard, 1990 for a full description). A review and synthesis of the literature, complemented and supplemented by the narratives of the students, suggests numerous issues and a glimpse of a powerful, unique experience.

But perhaps the one issue which transcends all others is the nature of the relationship between the ground that is "writing", and the figure which is "computer-based multi-media authoring". Intuitively it seems "right" that there should be some attributes or qualities which distinguish one from the other and so make them separate and identifiable. Indeed this is so, for the nature of the medium dictates the nature of the messages which emanate from that context. But by being described in recursive terms, we can allow the ground that is writing to foster and cultivate the figure of authoring which emerges. We do not need to speak in terms of separation and identifiability, for they are aspects of the same whole.

A metaphor of a hologram comes to mind, a multi-dimensional image which somehow seems to move out and away from the context of the paper which bears it. But is the image separate and distinct? Can the two images be separated, or is there another way to describe the relationship between them? I believe that there is, that the teachings of Maturana and Varela, of Bateson and Bruner, of Laszlo and Sawada and Kieren allow us to describe in a new way the nature of the relationship between the two. We will therefore see the ground in the figure and the figure in the ground, attributes and qualities, elements and processes shared between them.

After the fashion of the image of Hands drawing Hands (M.C. Escher, 1972) which is reproduced on the back cover of every issue, so writing and authoring "inform each other". The nature of the relationship between the ground that is writing and the figure of authoring that will in turn be the ground for new means and ways of articulating experience and understanding, is that of a hand drawing itself.

In reviewing the literature as regards the authoring process in hypertext, and in recording the descriptions of the student's experiences in the project work, the following attributes were a common thread that wove through the literature, their descriptions and our dialogues:

1. The authoring process was **recursive and reflective**:

Recursion is defined as a process which operates on the product of its own operation (Maturana and Varela, 1987, p. 253), a self-referential, reflective, levelled process in which any given process can be embedded within any other (Flower and Hayes, 1981, p. 366). Writing processes, by nature, are embedded, overlapping, recursive, and goal-directed (Montague, 1990, p. 7). Time and time

again it was noted by the students that they found themselves continually reflecting upon, re-vising and re-viewing their work.

The medium: What about reflection?

Stephanie (8): We're always reflecting on what we've done on the computer. Reflection was always a part of everything I did, like planning and doing and stuff, everything.

Abigail (8): I was always thinking back and it helped me not make so many mistakes, the process was easier every time because we took time to use what we had already learned, even if you had forgotten it, then we would think back and I would remember it again and then it would stick better and I wouldn't make the same mistake twice.

Chantel (8): You're always going back to them [the cards] or thinking about them, like sometimes after I drew a picture I had a new idea, and sometimes more information, and then I would change what I was going to do. Sometimes, like after PowerPoint, when we thought back on what we did, and stuff, I used a lot of that in HyperCard and it really helped, because I'd never kind of kept on using what we had already taken, like most times we would do something and then just leave it and not worry about it anymore, but this year we always kept thinking back and kept using what we already had done to make the new stuff easier.

Claudia (8): Whenever we wrote in our journals then we would think back, we would replay the thing over, and that's reflecting, right?

John (8): Reflection is what you do all the time, like you always think back, and like when I was writing in my journals, or even working, I would be thinking about what I had already done, and sometimes I would stop and go back and do something else real quick so I wouldn't forget and then go back and keep working on my new stuff.

Stan: My cards at the end were really good, but the ones at the front were terrible, so by the time I got to the end of my stack, I was going back and fixing up the front, and this process made my whole stack a lot tighter, a lot better. Every time I went back through my stack I saw things that I could do better, saw things almost differently sometimes.

Val: The more experience you have with it though, the more options become available to you, because my creativity was dependent upon how well I knew the program. The more confident I became with the program, the better my stack became, and lots of times I would go back and fix up a card, or add a new card, and change the linking because I'd discovered something that gave me other ideas, other possibilities. The more familiar I was, the creative I became.

The medium: I see a lot of nodding heads, so obviously this is something that happened to a lot of you, this revision as re-vision, seeing again, re-vision.

Doug: Well it did for me, it was an interesting experience being in the middle of it, but also

leading it, and then sometimes leaving it, coming back to it later, and reading it and thinking, "Oh wow, that's no good", so I was the writer and the critic and the reader all rolled up into one.

The medium: So getting back to the comparisons with other forms of writing, would you say that if the essay writing was linear, this was what?

Amy: Circular, but not in the sense of just going around and around, circular in that I kept going back and through and sometimes it would expand the project and it would improve, sometimes it even got worse! What I'm trying to say is that the circle was not a circle, a closed, round thing, it had inner loops, and bumps, and different paths around, in and through. And it wasn't two dimensional.

Celeste: What I write stays. I can't be bothered to re-write it, but not with HyperCard, in fact, I found myself continually going back to change and edit what I had done and it was a novel experience, and I was learning something about myself and improving myself at the same time.

Doug: I agree, I was trying to describe this project to my colleagues at work, and I started out by saying that it was like a tree, that you know, the rings of growth type idea were the rings of my getting to understand HyperCard better, but it wasn't that so much as it was like the tide, it would ebb and flow, sometimes it would come in farther, in other times it wouldn't, can you see the analogy?

Of particular interest here is the description of the process as being recursive, self-referential and evolutionary, but not circular or smooth. Many times I had this statement made to me that it was a very uneven process, full of plateaus, valleys and hills, that the process was not always progressive or continuous. The analogy of the growth rings of the tree not being able to convey the sometimes erratic nature of the process was important too, for in trying to describe the process of authoring as a wave, the student was trying to illustrate the continual redefining of the horizon.

In terms of the literature, Ken Davis (1989b) attributed this recursivity to the fact that "because hypertext is nonlinear or multidimensional, because it can allow scrolling forward or backward in time, it can allow student writers to see "behind" finished documents to the processes that produced them" (p.7). Thus we have the "ebb and flow", the embedded but levelled progression outward. What is most interesting to note is the fact that this process is anything but smooth and consistent.

Thomas Kieren (1990) has described this "ebb and flow" of process in terms of mathematical understanding, a process "entailing folding back for the reconstruction of inner level knowing" (p. 200). In this model, the learner folds back to an inner level of recursively described levels to reconstruct knowledge in order to move even further away from the basic skills or abilities they possess, in Kieren's terms, their "primitive doing" (p. 195). Similarly, the authoring process in hypertext

involved a folding back in terms of time, knowledge, and understanding.

> Nina: The difference for me was in the design process. I plan an essay in advance, and then write it, but with this, mine changed so much as I was working that the plan didn't help, so I had to keep going back too, and in a sense that was a benefit because as I was reviewing, I came up with new ideas, changed some things, and it seemed every time I did that, my stack improved. I understood more of what HyperCard could do, and a lot more of what I could do with it. The constant revision was excellent, and not boring because every time I went through the stack, the stack changed. There was always a sense of improvement.

2. The process was **reflexive and reciprocal**:

The term reflexive is meant here to connote the Self-referentiality of the authoring process, the personal aspect by which the project was a part of the person, not static and abstract, but an extension of the Being. It also had an aspect of Self-awareness, a sense of understanding themselves better in terms of what, how and why they did things, and yet it extended outward to make the process far more social and collaborative.

> Carrie (8): But also the computer reflects me, and what I know, you know, sort of like a mirror it reflects back something, well sometimes the computer reflects me, Carrie. I know that this is different than thinking back but that's what I thought reflection meant, you know like a reflection.
>
> *The medium*: That's interesting. How did the computer, a machine, how was it able to reflect you, the person?
>
> Carrie (8): Well, like in HyperCard I put in stuff that was special to me, and even somethings that, that maybe only I would know or even like. I think that you could tell that stack was mine if you knew me, you could say, even if you didn't know who did it, that, that was mine, because it's a lot like me.
>
> Trent: I like the idea of this project being personal, because usually all I do for an essay is string together information that I've found that supports my point, I don't add anything that's mine, anything that's original or unique to me. Almost everything I write belongs to someone else and I'm borrowing it. But with HyperCard, this project was mine because even though the information was borrowed, the way I presented it was mine, and I think that's really excellent, it was the most personal thing I've ever done.
>
> Craig: Yes, a lot more of me went into this project, my attempts at humor, my drawing, my organization. I think this stack reflected a lot more about me, the person. Most of the other stuff I've produced could have been written by anyone, I mean you erase the name and put in someone else's name and there'd be no way of telling them apart. But this stack is mine for sure, and I think that would go for all the other stacks I've seen people working on, because as I was

watching them I wouldn't have thought of some of the things they were doing, like that snake idea!

Celeste: You are gaining a lot more choice and freedom of expression. It almost lets you explore how you think and how you see things.

The medium: That's an interesting point about coming to know more about you, the writer. I see a lot of agreement once again, many nodding heads.

Pat: It was a case of me the learner, learning more about HyperCard, but also about how I learn, because in organizing, planning and presenting my topic, I was thinking about me and what I was doing, and how and why I was doing it.

Don: I learned a lot about me as a learner from my mistakes (laughing), because this was a new experience for me, and I realized that I learn more and better from making mistakes, and boy did I learn a lot! (laughing)

Pat: So again, it was your audience, like even though it had a structure, you had to limit it right, and change it so that it made sense to your audience. It would be really neat though, to have it so that the audience could fix it up too, then I wouldn't have to guess what I think they need, I could set it up in such a way that each person sort of uses it on their own, and can add to it, or change it.

Micheala: But when I read something, I get a different meaning out of it than anyone else anyway, so I suppose that means that when two people write something they would be writing differently too, even if the topic was exactly the same. When I write, I write for me, and I try to say it in such a way that it's right for me.

Val: Yeah, I guess that's the way it is for me too, like perhaps you wouldn't have put down what I did, or expressed it in those terms, but that's okay, I think that's the specialness of authoring, it's personal to the author.

Micheala: And the reader, yeah, and the reader.

There were no references in the literature to this Personal-ization aspect of the authoring process, yet clearly in these dialogues you can see the profound effect that working in this context had upon the students. Not only did the students notice a sensitization to themselves as authors and learners, but increasingly the process became far more social and collaborative, far more reciprocal both in terms of author/author, but also in terms of author/medium.

Craig: I lost many of my inhibitions and fears about sharing my work, in fact, I welcomed the opportunity to exchange ideas and ask for feedback. I don't know why, exactly, except that I was pleased with what I had done, and open to complement and appreciate the talents and efforts of others. Often while I was working in the lab, others would be working together in small groups which shifted and changed repeatedly.

Barrett (1988) describes this process in Vygotskian terms, for "the computer becomes a means for supporting a hyper-context of collaboration and dialogue - a social construction of knowledge" (p. 104). Certainly a community was forming, and a mutual respect was evident amongst the students for the efforts and talents of others, a respect which built upon the comments, suggestions and feedback provided by other class members who were likewise gaining in Self-confidence and awareness.

3. The process involved many forms of **complementarity**:

Complementarity is described as "an emergent actualization of processes which are mutually internested" (Sawada and Caley, 1985). In every instance, an on-going dialectic was described by the students as being critical to the authoring process.

> Celeste: As I was actually going through it I was asking myself what would I like to see next, I stepped into the role of the reader and tried to visualize what I would want, rather than just as the writer, because when you write you try to make it as good as you can for yourself, but this I was far more concerned with the perspective of the user. It made me think about where I should go next, what should I include, what are some of the other dimensions and topics.
>
> Trent: The interesting part about this project for me was that I was actually learning it as I went along. In trying to express it in a plan or outline, and then describe it in a card, I was actually the writer and the reader, the teacher and the learner.
>
> Nina: It was an interesting experience being in the middle of it, but also leading it, and then sometimes leaving it, coming back to it later, and reading it and thinking, "Oh wow, that's no good", so I was the writer and the critic and the reader all rolled up into one.

In the instances provided through the literature, there are many references to this unity which is at one and the same time a duality. John Slatin (1988) describes the text/context complementarity as "intertextuality, which might crudely be defined as the notion that a text (any text) is really a collectivity of other texts, so intimately and intricately bound to each other that they have to be described as mutually constituting each other" (p. 115); Marchionini (1988) describes the teacher/learner complementarity as an "opportunity to alter the traditional roles of teacher and learner, and the crucial interactions between them" (p. 9); while Blanchard and Rottenburg (1990) describes the writer/medium duality in which "they [hypertext and hypermedia] afford students an opportunity to enter a writing environment "that they shape even as they are being shaped by it" (p. 658).

4. The authoring process **reflected** the attributes of the medium:

The attributes of the hypermedia authoring environment have been described as multi-disciplinary, multi-media, multi-sensory, multi-modal, and multi-

dimensional. The authoring process reflected those qualities in the design and development stages.

Craig: I developed my topic, a choose your own adventure type concept, from the end back up to the front. I had an idea for the summary card, a synthesis sort of card where I would try to pull everything together, the solution, and then I worked backwards and developed each of the paths that led to that finish.

Shelley: I think it [planning] depends on your topic, because mine was math, and I needed to be able to explain the procedure clearly, it was a tutorial on roots, so I needed to plan everything out so that it was clear to me and then I could put it in. Perhaps the process depends on your topic.

Trent: That could be, because my topic was a choose your own adventure as well, and I felt okay deciding at that moment what was going to happen, but I see the point about explaining math in a teaching stack.

The medium: What about the nature of the process? Similar to the way you usually create or compose, or produce, or different?

Trent: It was a lot freer, because usually when I write I try to be coherent and cohesive, and sequential, like one main point after another, but with HyperCard it was a case of, oh, a tangent, explore it, and oh, another one and so on and so on, and all it took was keeping in mind the overall concept but then having the freedom to drift into whatever area seemed to be important.

Craig: Linear to me describes how I usually write, linear, yes, but this was anything but. It was not linear at all. The only problem I had was in keeping the connections, because I kept on thinking of new things and I would add some more, but then I was having to keep asking myself, "Why is this important? Will the reader want or need this information? How much is enough, and how much is too much, and what's needed and what's not?"

Doug: Yes, I agree totally, the advantage of having the freedom to create at will and add whenever you wanted was sometimes a huge disadvantage because it quickly became a mess, so I found myself going back through my stack any number of times as the user, and trying to justify the connections, and the information, and the way it was presented.

Amy: I agree with the statement about it not being two dimensional. That was one problem I had in designing my stack was that I would have liked to have worked in a three-dimensional form, I don't know how, but I had a lot of difficulty trying to conceive of my project on a flat piece of paper. My process too was really convoluted, more of a crazy looping than being circular.

Don: But that's the way I do everything anyway, in kind of a scattered way (laughing), really scattered, so it was good for me because that's the way I operate naturally.

> Stan: And yet I am very linear, very structured, and HyperCard was able to accommodate me, and at the same time accommodate the scattered types! (laughing)
>
> Trent: And every shade in between, because I did both, I would work logically, in order, and then when an idea came to me I would create a card, almost out of context, and then leave it, and sometimes I would go back and expand on it and include it, and sometimes I just deleted it and forgot about it. So there was both aspects of that in there for me.
>
> Val: I used a concept map, I put down all of the topics and the connections.
>
> Doug: The three dimensionality aspect of it was really neat, you could take off in so many directions from words, or pictures, and these would lead to others, rather than just being linear, I liked the scattered approach to creating something, but that's very difficult to do when writing.

The inherent diversity and potential for personal expression in a hypermedium seemed to facilitate the Person-alized experiences noted by the students. It did not appear to be a case of an external force, in this case HyperCard, effecting or eliciting change in the author. It was not in that sense, therefore, a stimulus-response effect. In fact, the exact opposite appears to have been the case. It was very much an "inside-out" experience of an author feeling very much in harmony with what the medium had to offer. Tom Kieren (1990) describes this relationship clearly.

> We picture the students as self-referencing, self-maintaining persons who can access their own thinking as part of their learning environment. What they do in any situation is not caused by this situation; it is determined by their own structure which is continually growing and changing. (p. 194)

5. The authoring process was a **systemic** process of looking for, creating and maintaining internal and external **coherence**:

John Slatin (1988), describes how this new medium places extra and new demands on both authors and readers to maintain coherence and unity through this network of discrete but related pieces of information.

> In so transforming the methods of organization which has served traditional text for millennia, hypertext requires authors and system designers to find new methods of indicating relationships, representing and constructing knowledge, and achieving coherence. (p. 882)

Similarly, the authors in the hypertext projects found maintaining a sense of unity was extremely difficult. It appears from their comments that the connectivity aspect, the creation and maintenance of inter-relationships between the elements was of constant and critical concern.

> Celeste: I used something like a concept map, and I was surprised how in putting it down in black and white how the way I organized my

> knowing about something was unique to me, because when I was skimming through some reference material, I came across a topic map, the same idea, and it was organized differently, same stuff, same material, completely different way of organizing and connecting it, and I think a lot of that has to do with this class, and the way that you've stressed the connectivity of everything, like that example we did (elaboration of knowledge from a single sentence). My organization stressed that, and was linked in a lot more ways than that guide. I was looking for connections, and not looking for uniqueness so as to separate it neatly.
>
> Val: In my concept map that's exactly what I did, look for connections, and try to see the relatedness of things, not the difference, because then I would better be able to, in one sense, guess the connections that the user might want to follow.

Locatis, Letourneau and Banvard (1988), listed the critical questions surrounding the linkage issues.

> In addition to thinking about what to say and how to say it, a host of additional decisions must be made. Many decisions concern links. One is whether links should be established. Another issue is where, how often, and how consistently links should be made. A third issue is how links should be denoted. (p. 70)

John Slatin (1990) also describes the constant need for "meta-textual coherence".

> Conceptually hypertext has a place in any environment where it's necessary or desirable to bring together large, complex, highly diversified bodies of information in such a way as to emphasize their interconnectedness. (p. 881)

The nature of hypermedia, therefore, is a continual process of creating connectedness, developing or maintaining inter-relationships, breaking the paradox of recursion by remaining coupled in, with, and through the hypermedium.

6. Knowledge representation, structural determination and organization, and linkage rationales were **critical, inter-related, on-going issues**:

Just as with Harste, Short, and Burke's authoring cycle, the "multimodalities" offered by the authoring environment were opportunities to express meaning and knowledge in formats other than textual. The students grappled with ways and means of expressing their concepts and ideas both in textual and graphical form, and achieving the right balance between them. Simultaneously, it seems, the questions surrounding the structure and organization of the composition were also being addressed on an on-going basis. Selecting a graphic to illustrate a point, for example, might lead to several possible nodes because of the amount of information contained in a picture, each of which further presented additional representation and organizational

issues. Hand in hand with issues concerning knowledge representation and questions regarding the structure and organization of the project, were the conceptual and practical issues of the linkages. Maintaining an overall unity and coherence was therefore an issue with which the students dealt with on a formative basis.

Amy: We [a small group] all started thinking structure and organization not only as we were developing the projects, but at the same time as we were deciding on the topic itself. Then once we started our projects, we dealt with those same questions every time we worked on each card.

Val: For myself though, it wasn't so much the information, but it really forced me to decide how I would present it, and whether I'm presenting that information in a logical, coherent way, a way that would make sense to someone who is learning my topic. But also I thought about changing the format, like from words to pictures, or paragraphs to charts and graphs. Even though I'm living my topic every day, it really forced me to make sure that I knew that my links were complete.

The medium: So what was it about HyperCard that made you think about it for so long before you began?

Pat: I think for me it was the buttons.

Micheala: Yes, you could go to any card, and so I was always thinking about why would I want to go there, say, and then it would make me think about how I was going to bring all this together, like, going from the small picture and stepping back, and then moving into the details and back and forth.

Celeste: Yeah, the key was to link it right, and sometimes I didn't know what right meant.

Trent: I had three topics, but I felt that the branching and linking capabilities of HyperCard were more suited to my final topic than to the others that I discarded.

Shelley: I designed each and every card, including buttons before I ever touched the computer. I spent some time getting familiar with HyperCard and experimenting with different options, but before I began the actual creation of the project I had drawn, in detail, every card in my stack. Interestingly, a lot of it changed after I began working, but at least I had a base from which to work.

Celeste: Selecting a topic would depend on how much you knew about your topic beforehand, because the more you know, the more you can sense the structure as to how it could come together, but not knowing a topic would require, for me, that you develop some form of outline so as to relate or arrange the pieces properly. I think it's critical to know what you're working with and how it all fits together, otherwise it will be like a bowl of spaghetti.

Val: HyperCard just leant itself to what I was doing. I did a stack on audiology, and the structure of the topic was explicit, this lead to that,

> which could lead to this or that and so on, and as I sat down and jotted down the concepts, the way they lay there on the paper was the outline for a stack, including all the connections and everything.
>
> Yvonne: I agree, it was never a case for me of trying to force HyperCard to do something that it was not intended to do, and even though I thought of four, maybe even six or seven different topics, I always saw how it could be done using HyperCard, and my topic was in Agriculture, and still, in fact, I actually started two assignments, one a database on herd management, and the other a simulation on feed and waste management.

Given the nature of the medium that is hypertext, it's elements and attributes, it should come as no surprise that the topics of knowledge representation, structure and organization, nodes and links, predominate the literature on authoring principles and issues. It is at this juncture, however, that the philosophical debate as to the role of hypertext and hypermedia presents us with two perspectives on the approach to the description and resolution of the issues.

In terms of the "referential" perspective, the literature abounds with the technical considerations of types of hierarchies, node characteristics, linkage attributes, learner control, navigation, help mechanisms, validity, assessment, and so on (Kearsley, 1988; Jonassen, 1988b; Kinzie & Berdel, 1991; Locatis, Letourneau & Banvard, 1988; Marchionini, 1988; Morariu, 1988).

In what Byles (1988) has termed the "inferential" perspective, the reader is left to construct their own meanings through personalized experience and engagement. Mary Huston (1990) addresses the issue from the "inferential" perspective where the emphasis is on construction as opposed to the collection of meaning.

> Following the Wittgenstenian dictum that meaning is determined by use, the concepts themselves cannot be construed as given; rather, they must be tailored to the contexts in which they emerge (1958). Emphasis must be shifted from the retrieval of intact, rigid, precompiled knowledge to the construction of knowledge from the precedents of earlier, context-bound, concept applications. Far from being compartmentalized, such knowledge implies a recognition of the 'deeply intertwined' and multiple interrelatedness of knowledge. (p. 338)

As the nature of a medium changes, so too must the messages which emanate from that medium. In this case, the medium is authoring, and the change is one from a paper-based, linear, sequential, two-dimensional medium to that of a computer-based, multi-dimensional, multi-modal, multi-media authoring environment. Figure 3 below illustrates the meaning of the messages from the medium that was HyperCard.

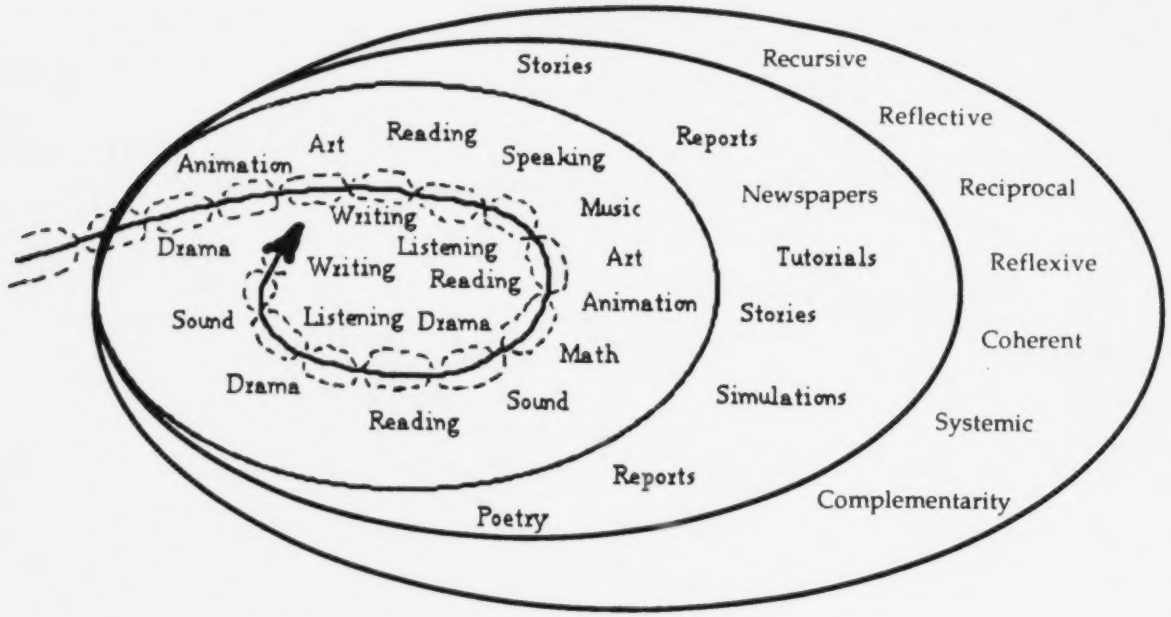


Figure 3: medium/message/meaning

Summary

The term Hyper-, as a prefix, denotes the concepts of above, beyond, or surpassing. It is in this context, therefore, that the terms hypermedia and hypertext have been coined to exemplify an authoring environment in which the media and the text itself, can be transformed into something else, something that goes above and beyond our conceptualization of what technology, media, and the authoring process can do, represent, or can become.

Hypermedia is not a single technology, but a mixture of technologies (which can include information from any number of video and audio sources), controlled by hypertext (Blanchard & Rottenburg, 1990, p. 657). In hypermedia authoring, technological advances allow for the incorporation of text, graphics, sound, animation and video into discrete nodes of information which are then linked together based on certain criteria for relationship.

From the perspective of a both an author and reader of hypertext, hypermedia is an empowering, personal, dynamic, open-ended, multi-dimensional environment that allows for the personal construction of meaning.

Based upon the work of Harste, Short, and Burke (1988), a paradigm was proposed which describes the authoring process in hypertext, but accounts for the enhanced opportunities for expression in that technological context. Those enhanced opportunities included animation and sound, plus the potential for the

incorporation of video and still photographic images.

The meaning of the messages which emerged from the context of hypermedia authoring present a daunting task. A review of the literature, complemented and supplemented by insights from post-secondary students who were involved in a hypertext project, suggest that the authoring process had six critical aspects: (1) is **recursive**, in that it was an embedded, self-referential process, but not necessarily continuous or smooth; (2) is **reflexive and reciprocal**, in that it emphasized the Self-awareness but also had an outward-looking, social, collaborative aspect as well; (3) has many aspects of **complementarity**, a process by which mutually internested aspects engage in a dialectic process; (4) **reflected** the attributes of the medium, those being multi- media, sensory, disciplinary, modal, and dimensional; (5) was a systemic process of looking for, creating, and maintaining both internal and external **coherence**; and (6) dealt in a **continuous**, simultaneous fashion with the issues of knowledge representation, structure of the topic, and the nature of the relationships or links between the elements.

The metaphor which perhaps most clearly describes the unity and inter-relatedness of hypermedia is that of "a web, in which anything that affects one strand of the web vibrates throughout the whole" (Cooper, 1986, p. 370). The ecology of hypermedia, therefore, is a continual process of creating connectedness, developing or maintaining inter-relationships by remaining coupled in, with, and through, the hypermediam.

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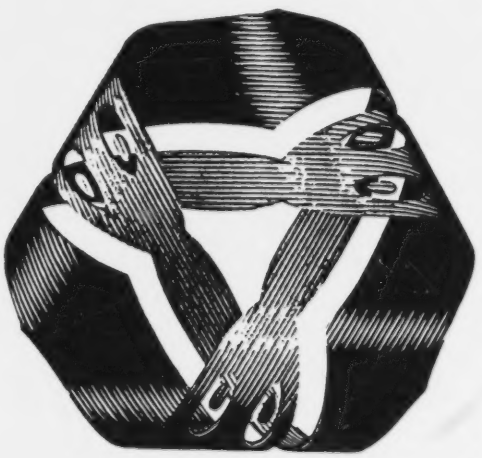
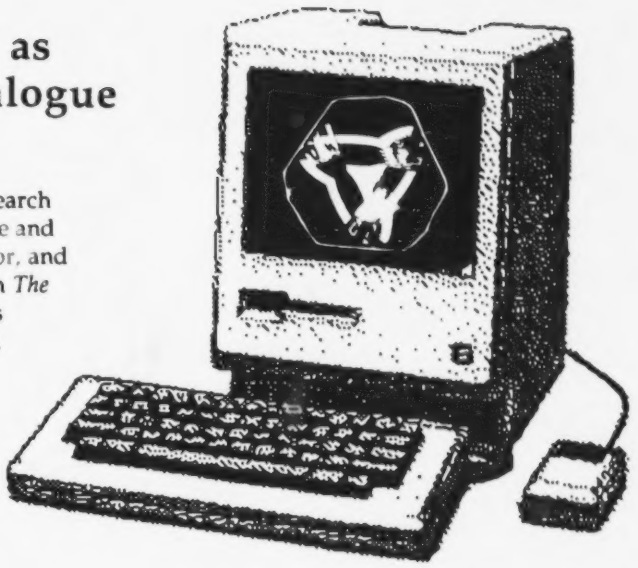


Editor as author as publisher: A dialogue

Abstract: At any point in the research process, Stephen Kemp was at one and the same time an author, an editor, and a publisher. In conversation with *The medium* , Mr. Kemp discusses this approach to naturalistic inquiry.



The medium : Mr. Kemp, would you please explain for our readers exactly what you authored, edited and published.

Mr. Kemp: Well, perhaps I'll start from the back and work towards the front in answering your question! I am the publisher of a journal entitled *The medium*, a journal which serves as the format or vehicle for my dissertation.

The medium : And what is the nature of your research?

Mr. Kemp: My dissertation is an inquiry into the nature of the authoring process using a computer as the medium of articulation. Specifically, I am interested in describing the authoring process in a medium in which authors compose with more than just text and graphics, they can now incorporate a variety of media including sound, digitized graphics, and animation.

The medium : So what is the link, then, between your dissertation research, and this journal?

Mr. Kemp: I think the answer is in the title of the journal itself, a sort of self-referential, recursive process. The title of the journal reflects the nature of the research, and the research question. To use the term medium in the title of a medium, and to have been looking at a medium as my research question, to me sums up the very essence of what I was trying to do. My interest lay in the area of authoring and publishing, so to author and publish a journal called *The medium* was a means, a way, of articulating that experience which was resonant with what I was trying to do.

The medium : So *The medium* as a journal, then, is symbolic of the nature of your research and the question which you were investigating?

Mr. Kemp: More than symbolic, I like to think it was iconic, self-referential, able to be experienced. To me, a symbol is inert, a representation, a static means of communication. But an icon represents in itself the essence of that which it is representing, it is a metaphor, a poem of sorts.

The medium : So the journal is a metaphor?

Mr. Kemp: Yes, but so are all of the aspects of the journal. Take the title for instance. A medium is defined as including one or all of many aspects: It can be a tool, a device; it can be a means or agency of change; it can be an intervening substance through which change can be effected; and it can also be an environment, a context. So to use the title "*The medium*", was also a metaphor for the nature of my research and the process which I followed in trying to understand that lived experience of understanding the medium of authoring using a computer. My journal is all of the above, it was a tool, a means, a way, an agency, a context. My research was all of the above. My research question looked at the nature of a particular medium. So everything's intertwined, just like the Moebius strip configuration, an M.C. Escher print, in the banner at the beginning of the article.

The medium : So if everything in the journal is intertwined, what about your roles as author, editor and publisher?

Mr. Kemp: Yes, here again, everything is intertwined. It wasn't as if at some point I was an author, and then suddenly became an editor or publisher and stopped being the author. I was all of those things continuously. And here again, I was trying to capture the essence of what I feel is the nature of all things, all processes: complementarity.

The medium : Complementarity?

Mr. Kemp: Simply put, it is a balance, a harmony among what might at first appear to be separate, mutually exclusive aspects of a process. I have often fallen back on the seeming paradox of the nature of light, which can have at one and the same time the attributes of both a wave, and a particle. But how can that be? How can one thing have two, separate, mutually exclusive aspects? Doesn't that mean that one is right and the other wrong? No, on the contrary. What it means is that for a full description all aspects must be considered. And so it is with authoring and editing and publishing. These are not three, mutually exclusive components which can somehow be separated and described irrespective of the other. They are three aspects of the same process, a process which is usually termed authoring. Going back to that Escher print, each of the three might correspond to one of the sides of the Moebius strip. But there is no beginning and no end, it is continuous.

The medium : I'm curious as to where the idea for this journal came from.

Mr. Kemp: Well, it's interesting really, but I guess the best way to describe almost all of what I have imagined

and conceived occurred (to use Sr. Theresa Craig's concept), twilight imaging plus about 8 hours or so! Unlike Sr. Theresa, I allowed my mind to drift in the early hours of the morning instead of late at night. The idea for the journal came in early January of my residency year, and like so many others, it literally just emerged from seemingly out of nothing or nowhere. I do not even remember thinking specifically about my research interest or my question. Literally, the idea just was there, and once I began to think about it, how it was a way for me to describe the nature of something using the attributes or qualities of nature itself, then the idea began to become more firm.

The medium : What are those attributes that you alluded to?

Mr. Kemp: From my readings of Humberto Maturana and Francisco Varela, Terry Winograd, Ervin Laszlo, Jerome Harste, Frank Smith, Donald Graves, Lucy Calkins, Jerome Bruner, Gregory Bateson, Seymour Papert, Gary Zukav, Daiyo Sawada, and so on and so on, there began to emerge for me a sense of the nature of a context, an environment, a medium. That sense has led me to believe that an environment has three attributes, or qualities, what I call the three R's: it is recursive, that being a levelled, evolutionary process of growth and development; it is reflexive, or a self-referential process by which it is the agent for it's own change and development; and it is reciprocal in that an entity must remain open yet coupled, a Maturanian term, coupled with it's environment or it will disintegrate and perish.

The medium : So now we seem to have come full circle, because if all things are a medium unto themselves, then the attributes which you have described must necessarily apply to your journal?

Mr. Kemp: That's exactly it. I wanted my journal to not simply represent symbolically the concept of a medium, but to do so iconically, in that it was recursive, reflexive and reciprocal.

The medium : So in what ways then was your journal, and necessarily, your roles as author, editor and publisher, recursive?

Mr. Kemp: There are a myriad of examples I could give to you, some very subtle, others very overt and obvious. For instance, in terms of the journal, I worked with all three issues of *The medium* on the desktop of my computer at the same time. Using the window option, I was forever moving backwards and forwards, adding to one, moving ideas, sentences, paragraphs, even whole articles from issue to issue. Ideas that were alluded to in one issue became the ground for the next. I was writing longitudinally.

The medium : Can you give me a specific example?

Mr. Kemp: The medium, if you will, for *The medium*, was, and is, my journal. I began keeping a journal shortly after I arrived in Edmonton, and it is full of ideas, doodles, drawings, quotes, anecdotes, plastic wrap of mints following tea, notes and xeroxed pictures. *The medium*

evolved out of my journal, and each issue emerged from the one previous. The proposal issue, for example, described aspects of my review of the literature, my question, my research methodology, and so on. That in turn became the ground from which the first issue emerged. For instance, in the Welcome to Macintosh issue, there was a discussion of the nature of the computing medium. This formed the basis for the second issue, Understanding hypermedia, in which we described the nature of one specific medium, HyperCard. In there was a reference to ecology. The term was introduced and described in that second issue, but became the dominant theme or perspective for the third issue. Similarly, this notion of ecology was extended into the fourth issue to emerge as a discussion of the nature of the authoring process. Finally, the fourth issue will be entitled "The nature of the authoring process in a computing medium" which is the subtitle of the journal itself, and the title of my proposal document from which all of this has evolved.

The medium : And reflexive?

Mr. Kemp: Well, our earlier discussion about how the journal itself, the title, the research question, the research process, everything is self referential. If not for the recursivity, however, the whole thing would become cyclical and there would be no levelling, no growth. Even this article is reflexive, is it not?

The medium : Either that, or schizophrenic!! But let's stay focused shall we? Now what about the reciprocity?

Mr. Kemp: Well the reciprocity happened on many different levels. There was the obvious reciprocity of myself being both the author and editor and publisher, I was forever blending or melding the roles and perspectives of one into the other until trying to make a distinction became meaningless. There was the reciprocity between those aspects and my other roles as teacher and learner and researcher. There was the reciprocity between myself and the grade 8 students and post-secondary students that I had the privilege of sharing the journey. Then there was the reciprocity between the students, and between the students and the technology, between myself and the technology, and so on and so on.

The medium : So it was a very dynamic medium?

Mr. Kemp: Oh, absolutely, in fact, there were many instances where I was sure that it had degenerated into a chaotic situation. And I mean that sincerely, because there were so many times when I felt completely overwhelmed. In the words that my grade 8 students might have used, it was major immersion! I was at one and the same time both in and out of each and every situation, creating and observing, talking and listening, directing and being directed. I was writing and reflecting, reading and thinking, doing and not doing, Being and becoming. But I guess the thing that got me through it all, and the one thing that grabbed the interest and excitement of the students as well, was the pride, the exhilaration, of seeing

the issue printed and published! I will never forget the first issue of *The medium*, published in late January, 1991. I was, as Lucy Calkins states, Living between the lines, and once my students saw their words, their ideas, their compositions, their articles published in our first issue, it was the same for them, I know it. The medium became our narrative, a context which described our journey together.

The medium : So you obviously are very pleased and excited with the process.

Mr. Kemp: It was, without a doubt, the best year of my entire teaching and learning and researching career. Again, to quote my grade 8 students, it was awesome!

The medium : Why?

Mr. Kemp: Because I was trying to understand, to be a sensitive describer and interpreter, to allow a narrative to unfold in all of it's wondrous dimensions. Sometimes it was a comment, sometimes an event like bringing a camel to life, sometimes it was an observation, sometimes a glance, sometimes it was a product, sometimes a process. It was a process of being in touch, of being in harmony, of being open, of growth.

The medium : And the difficulties?

Mr. Kemp: Well there were many. I was so close to everything, that I often needed to distance myself from the goings-on just to look up and around, to see the larger context. Another difficulty I had was in trying to sensitively describe the process while doing justice to the effort and abilities, creativity and imagination of the students. That's why I included the companion diskettes, because as Dr. Milt Petruk asked me at my Candidacy oral examination, Does changing the nature of the medium change the nature of the messages which emanate from that medium? I sincerely believe that it does, which is why I included the actual student compositions so the readers could appreciate them for themselves, construct their own meaning as it were. Another difficulty was the necessity of constantly being opportunistic, taking stock of every possibility and trying to not blatantly cull and exclude opportunities for learning. On the other hand, trying to accommodate and provide opportunities was difficult because of the limited access to the lab, and the other demands placed on both myself and my students.

The medium : And in terms of being author, editor and publisher?

Mr. Kemp: Well, again, the closeness. I was making all of the decisions as to what to write, how to write it, how to combine the graphics, the format of the articles, the formatting of the page, the creation of all the graphics, the decisions as to what articles belonged in what issues, and so on. As I said before, I literally created all of the issues on the desktop at the same time, and that was tremendously exciting, but also very demanding. Sometimes issues within a particular would suddenly emerge that were completely unexpected, but were important enough to modify what I had already done. Then sometimes my readings

would spark something and that might even lead to a whole new article. I remember attending a workshop on evaluation and assessment that precipitated my interest in concept mapping, a very important aspect of our year.

The medium : But if this project was to be reflective of the year, the journey as you say, then it had to be that way.

Mr. Kemp: Absolutely, it was, as Maturana and Varela state, a question of being structurally coupled. The medium had to be resonant with the media which impacted on it and in turn were impacted upon, and those media included myself, the technology, the students, parents, and any other entities which came into contact with our community.

The medium : Is this notion of being structurally coupled analogous to the attribute of reciprocity that you mentioned earlier?

Mr. Kemp: Yes, as I said earlier, there are three attributes or qualities that I believe all environments or contexts must possess, and one of these is reciprocity. To be an open environment necessitates that there be on-going transactions between the entities in that system. This is perhaps the basic tenet of the systemic view of the nature of all processes.

The medium : Interesting. So, is this concept of a system, then, is that the key? Is the tripartite nature of being an author and an editor and a publisher a systemic approach to research?

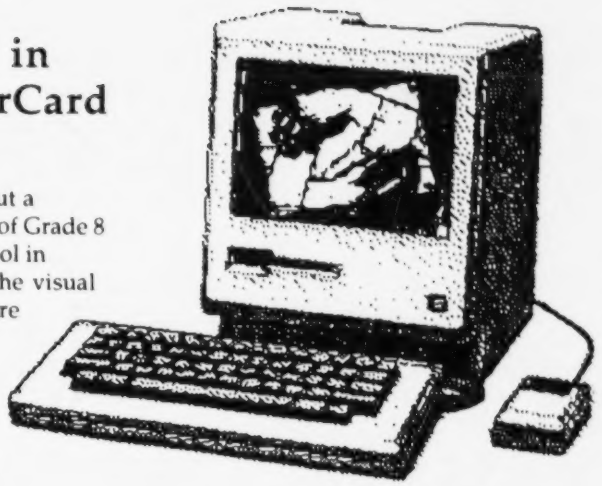
Mr. Kemp: Yes, and not only to research, but to teaching and learning and reading and writing and all processes in education. This is perhaps the greatest insight which I have come to appreciate from my experiences these past two years. We have to move away from a systematic approach to the nature of teaching and learning, and move towards a systemic philosophy. In fact, to get back to your question about how recursion has been an attribute of this journal, that is perhaps the essence of this process. We have moved in these journals from a focus on the technology, to the lab, to the student, and then, finally in the summary issue, to a discussion of the whole process from a systems point of viewing. But this insight is the next, and summary issue. Could I leave it at that for the time being?

The medium : Indeed, yes, any further comments?

Mr. Kemp: Well, none, except perhaps to say that this process has only affirmed for me those tenets of my philosophy of teaching and learning and researching and authoring that I felt were important but of which I lacked the actual experience. The medium, as a narrative of the journey of a teacher and his students, is that affirmation. I can only hope that I have done justice to the enormity and importance of that experience in my life, and in a sense of complete respect and gratitude, to the wonderfulness of that journey with those very special students from Bishop Pocock School in Saskatoon. It was a magical experience!

The medium : Thank you for your time!

Student compositions in the medium of HyperCard



Abstract: *The medium* is proud to feature but a selected few of the many fine compositions of Grade 8 students at Bishop Pocock Elementary School in Saskatoon, Saskatchewan. Included with the visual representations of the HyperCard stacks, are descriptions by the students of their compositions. In addition, 2 companion diskettes have been made available so that subscribers may enjoy and appreciate for themselves the efforts of the students.

The following compositions have been selected from the more than 30 compositions which the students at Bishop Pocock Elementary School produced during the course of less than 8 weeks. All of the compositions chosen for inclusion in this article are original pieces of authoring, and have been selected on the basis of their creativity, imagination, and use of the range of authoring tools available both in HyperCard and using MacRecorder.

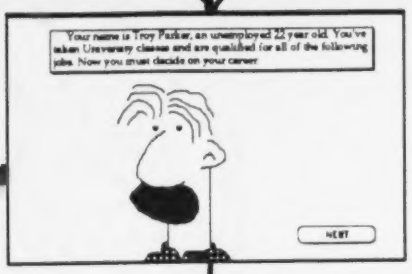
All of these samples, as well as others which indicate other possibilities which might emanate from such an authoring environment, have been included in the two companion diskettes which accompany this issue of *The medium*.

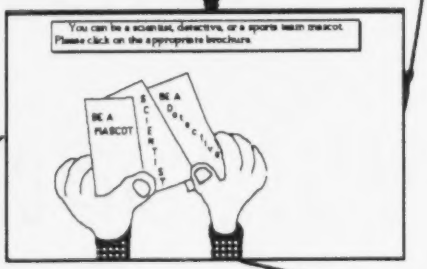
Career Opportunities

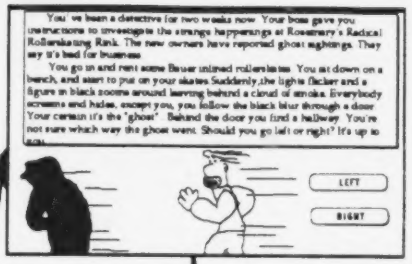
by John McGrath

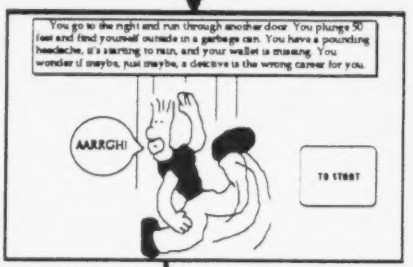
My HyperCard project is an interactive story where the reader gets to make decisions. The main character, Troy Parker, has to decide what his career should be. He can be a detective, scientist, or a sports team mascot. Most cards have a decision to make but if the wrong path is chosen, the reader comes to an untimely end. The deaths range from electrocution to a nuclear explosion to being crushed by a monster who lives in a tuba case. This story is not meant to be educational, I intended it to be an entertaining effort for the reader and an example of the fun I had using my imagination in HyperCard.

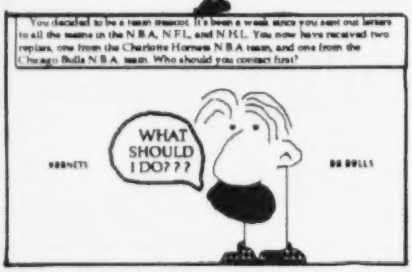
Career
OPPORTUNITIES
NEXT

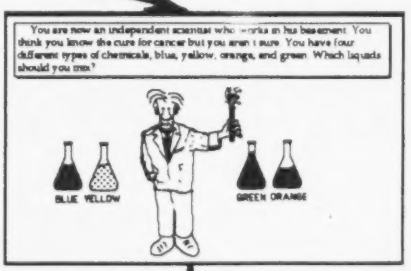

Your name is Troy Parker, an unemployed 22 year old. You've taken University classes and are qualified for all of the following jobs. Now you must decide on your career.
NEXT

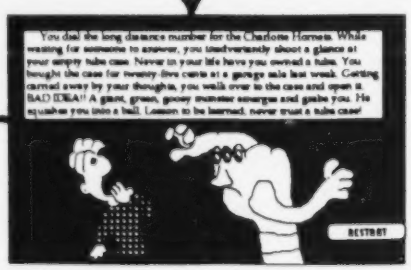

You can be a scientist, detective, or a sports team mascot. Please click on the appropriate brochure.
BE A MASCOT
BE A SCIENTIST
BE A Detective

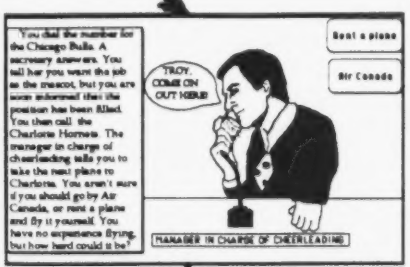

You've been a detective for two weeks now. Your boss gave you instructions to investigate the strange happenings at Rosemary's Radical Rollerskating Rink. The new owners have reported ghost sightings. They say it's bad for business.
You go in and rent some Bauer inlined rollerblades. You sit down on a bench, and start to put on your skates. Suddenly,the lights flicker and a figure in black zooms around leaving behind a cloud of smoke. Everybody screams and hides, except you, you follow the black blur through a door. Your certain it's the "ghost". Behind the door you find a hallway. You're not sure which way the ghost went. Should you go left or right? It's up to you.
LEFT
RIGHT

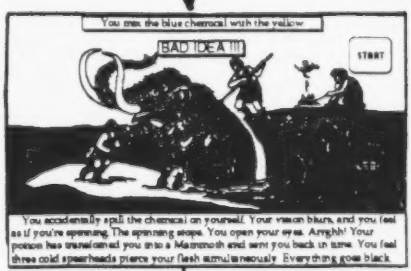

You go to the right and run through another door. You plunge 50 feet and find yourself outside in a garbage can. You have a pounding headache, it's starting to rain, and your wallet is missing. You wonder if maybe, just maybe, a detective is the wrong career for you.
AARRGH!
TO START

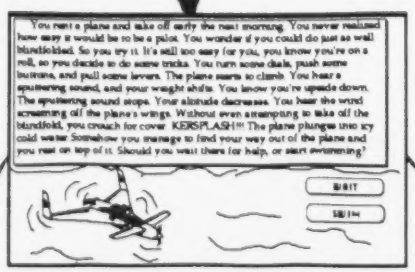

You decided to be a team mascot. It's been a week since you sent out letters to all the teams in the N.B.A, N.F.L, and N.H.L. You now have received two replies, one from the Charlotte Hornets N.B.A team, and one from the Chicago Bulls N.B.A. team. Who should you contact first?
WHAT SHOULD I DO???
HORNETS
BB BULLS


You are now an independent scientist who works in his basement. You think you know the cure for cancer but you aren't sure. You have four different types of chemicals, blue, yellow, orange, and green. Which liquids should you mix?
BLUE YELLOW
GREEN ORANGE


You dial the long distance number for the Charlotte Hornets. While waiting for someone to answer, you inadvertently shoot a glance at your empty tube case. Never in your life have you owned a tube. You bought the case for twenty five cents at a garage sale last week. Getting carried away by your thoughts, you walk over to the case and open it. BAD IDEA!! A giant, green, goony mammoth emerges and grabs you. He squishes you into a ball. Lesson to be learned, never trust a tube case!
RESTART


You dial the number for the Chicago Bulls. A secretary answers. You tell her you want the job as the mascot, but you are soon informed that the position has been filled. You then call the Charlotte Hornets. The manager in charge of cheerleading tells you to take the next plane to Charlotte. You aren't sure if you should go by Air Canada, or rent a plane and fly it yourself. You have no experience flying, but how hard could it be?
Rent a plane
Air Canada
TROY, COME ON OUT HERE!!
MANAGER IN CHARGE OF CHEERLEADING


You mix the blue chemical with the yellow.
BAD IDEA !!!
START
You accidentally spill the chemical on yourself. Your vision blurs, and you feel as if you're spinning. The spinning stops. You open your eyes. Arrghh! Your potion has transformed you into a Mammoth and sent you back in time. You feel three cold spearheads pierce your flesh simultaneously. Everything goes black.


You rent a plane and take off early the next morning. You never realized how easy it would be to be a pilot. You wonder if you could do just as well blindfolded. So you try it. It's still too easy for you, you know you're on a roll, so you decide to do some tricks. You turn some dials, push some buttons, and pull some levers. The plane starts to climb. You hear a sputtering sound, and your weight shifts. You know you're upside down. The sputtering sound stops. Your altitude decreases. You hear the wind screaming off the plane's wings. Without even attempting to take off the blindfold, you crouch for cover. KERSPLASH!!! The plane plunges into icy cold water. Somehow you manage to find your way out of the plane and you rest on top of it. Should you wait there for help, or start swimming?
WAIT
SWIM

The first thing I did was decide that I was going to make a funny, imaginative character in an interactive story. After I had chosen a main character, I began to think of situations to put him in. After a lot of different possibilities, I chose making him pick a job. The ideas came from some things I had done before, and ideas that my friends gave me. I decided on the three most difficult jobs I could think of: detective, scientist, and sports team mascot. I wrote down on paper what I had thought of, but just the beginning for each of the three adventures. I also drew some pictures that I wanted to include for each of the three stories, just to practice being able to draw the same man on every card in different situations. I planned out the first 5 out of the total of 25 cards that I finished up with. For these 5 cards I copied onto the computer exactly what I had done on paper in my design document. Later on, as I was working, I made up the rest of the cards as I went along. My friends gave me lots of good ideas, and when we were working in the lab I had time to plan ahead while I was working. I always typed the text first, and then added a graphic after. I usually do one card at a time, unless I get bored with it, or come up with another idea. I usually started each session in the lab by first re-reading what I had done. Lots of times I got good ideas, and new ideas too. I was really happy with my stack and it was a lot of fun to do. I wish that we could have had more lab time because I would have really liked to do another project in HyperCard. It was the best thing we did on the computer.

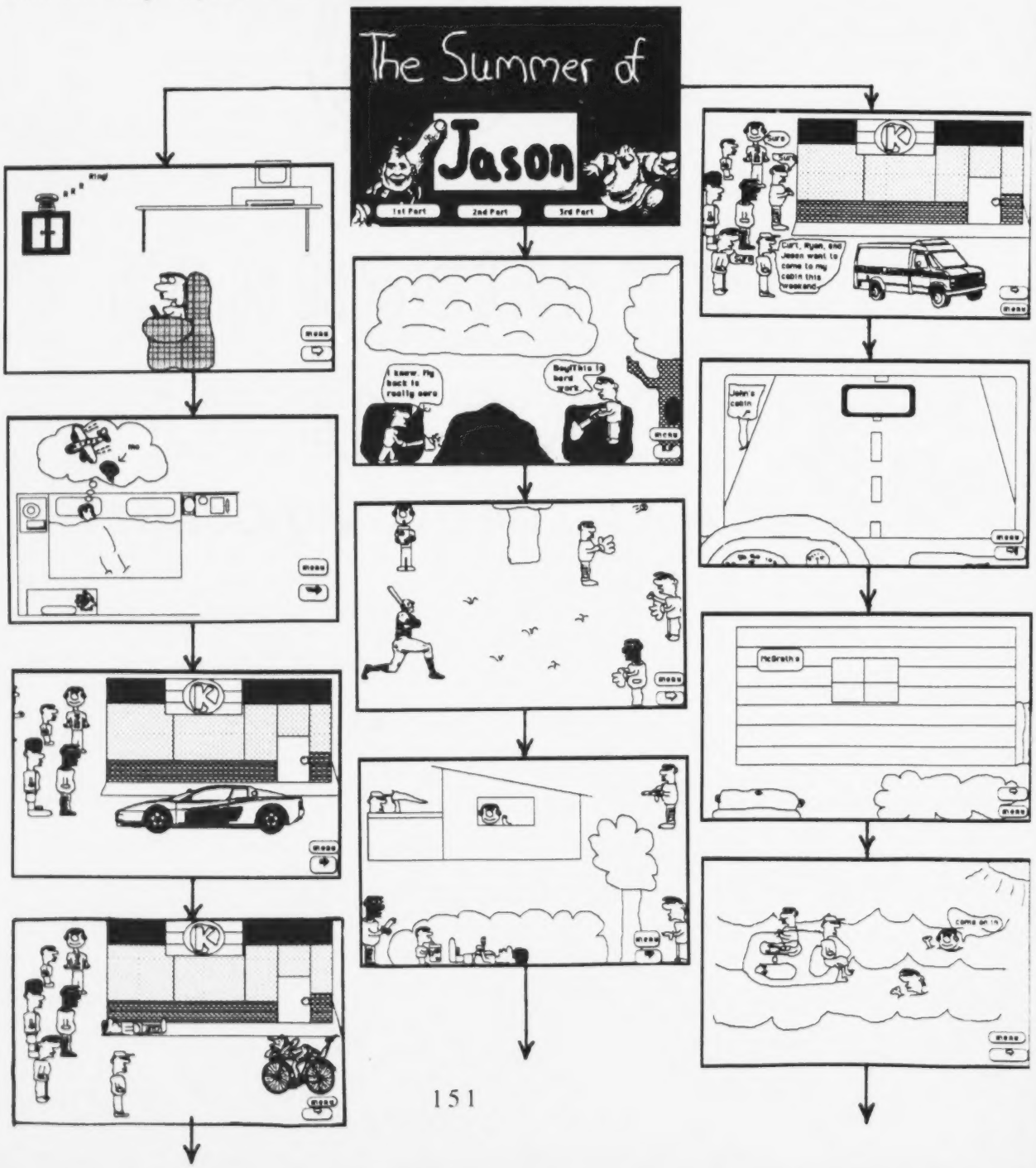
The Summer of Jason

by Jason Marien

My project is about my summer last year. I split my summer into three different parts and in each part I have a section of cards which I drew on to show what I did in that part of my summer. I am hoping I can put sound into my project with MacRecorder later on. My summer was mostly going to Circle K and to the mall, but I also went to the lake to work for my dad digging pits, and also I went to John's cabin for a weekend. So for my project it was mostly going to be pictures with cards and sounds, and then after every section I have a divider card so you can go back or forward.

For the design of my stack I just thought of a few topics and I finally chose to go with what happened in my summer last year. I simply put down on paper what happened and also some of the highlights of my summer. My teacher, Mr. Kemp, gave me the idea of putting sound into my stack and also separating my summer into three parts so it might be easier to put together and not so boring for the reader. I talked to some of my friends so that I could remember all of the amazingly fun things that we did together. I chose to put buttons on my cards in various places so that when people looked through my stack they could have an easier and more fun time going through it. I chose to use some Clip Art but not so much that I had to do all the work but just enough so that it made my stack look better. I picked some Clip Art pictures of things I couldn't draw so good. I

chose to put sound into my cards and have my friends and me talking to one another and in some, me talking to my dad. I didn't plan out all of my cards in a design document because sometimes I couldn't think of anything to write, but once I started to work on the computer it all started to come together. When I was drawing the people in my project I decided to trace them and just paste them into different cards because I knew I had to use them lots. When I was drawing I always made changes because the other people in the lab gave me good ideas, or sometimes they helped me out when I asked for their advice.



The Rubber Chicken

by Michael Fernuk

My HyperCard project is about "The Rubber Chicken", a comic book superhero. The story of the Rubber Chicken is an interactive story which puts you in the lead role. Your arch enemy, Dr. Potatohead is back, with advice which allows him to clone himself and make an army of thugs to help him take over the world. That is the point of the story, to stop Dr. PotatoHead, and enjoy yourself.

To start off my stack, I had to think of an idea as to what it would be about. I decided I would do an interactive story. Then I thought about what it would be about. I thought about making a spy story like a James Bond thing, but I couldn't think of any way of making an interactive story out of this idea. Then I got the idea of having a superhero story. I thought about how I could make a story out of this idea and thought of many ways, so I decided to go with this idea.

I decided the next best thing I could do would be to think of a superhero. I couldn't think of one until I was lying in bed and I saw in my closet my rubber chicken, which gave me the idea I stuck with. I also saw a Mr. PotatoHead toy which gave me the idea for my hero's enemy.After I thought of my characters I thought of my plot. I got the idea for the cloning machine because my dad was watching a movie that happened to mention cloning. When I had the basic plot down, I began to work on an outline. I did my outline by briefly explaining each card and deciding what that options and next card would be as soon as I got there.

After I had done the outline I decided to draw out each card. I took a long time on this, drawing as best as I could of what I thought that card would look like.

After I had done the drawings I did the text. I thought for a long time of what I would put on each card, and I took my time because when it came time for me to work on the computers I wanted to just be able to copy out of my journal and not do much thinking. It turned out that I did keep much of the same text and ideas.

I then took a short time and designed my two main characters. Then I started work on the computer. I just looked at my design document and pretty much did what I had written down. I did my work one card at a time. I also did them in order, except for when I came to a card which had two paths down which you could go. In this situation I always went to the direction in which the person playing would end up dying quicker and when finished that route I would go back and continue the other one. When I had finished the stuff from the design document I added buttons and linked everything together. Then I added a few more cards, a title card that explained the story, and a card that explained who you are in the story. Then we had people go through our stacks and read them and suggest changes and point out the mistakes. I had lots of good comments and everyone really liked it. One change they suggestedwas to add animation and sound, so I went back into my stack and added an animation sequence, and then I used MacRecorder to make sounds. We did this in the little

room beside the lab, and it kind of was like a little recording studio. I used my friends to help me make the sounds and it was great. We had a lot of fun. This was the most fun I have ever had working on any project. I think this is the best thing that I have ever done.

You are...
...Rex Hamil A.K.A.
THE RUBBER CHICKEN
NEXT CARD
THE STORY
NEXT CARD
The place is New York, the crime capital of the globe, You are the Rex Hamil, also known as ... the Rubber Chicken. Yes, America's favorite comic book superhero.
After a long period with little action, you get word that one of your deadliest foes is back...
Dr. POTATOHEAD!!!
Yes he's back and he's got one of his worst plans yet. He has made a cloning device which is able to make millions of Dr. PotatoHead's with slight changes. With this he plans to make an army of thugs which will help him to take over the world.
You must stop him or the whole world will suffer.
WHEN FINISHED CLICK ON "THE END"
One afternoon while watching TV you see something on the news.
NEXT CARD
In the news Dr. PotatoHead struck. RUBBER CHICKEN, we need your help!!!!
NEWS
SOUND
"Should I save the world?" you wonder.
Yes
No
You decide to let someone else take care of Dr. PotatoHead. He takes over the world. You are truly a wimp.
THE END
HAHA!
SOUND
You decide to face your foe as your alternate self..... THE RUBBER CHICKEN.
NEXT CARD
You decide if would be easier to find Dr. PotatoHead by just driving around.
NEXT CARD
Look everybody the RUBBER CHICKEN!
VROOM
THE CHICKEN MOBILE
Where should you look for Dr. PotatoHead?
Try to find him by using your computer.
Just drive around and hope you run into him.
You try to find him by using your computer.
FILE: DR. POTATOHEAD
NEXT CARD
While driving around you see Dr. PotatoHead and his thugs robbing a bank.
BANK
You go in the bank with hopes you can stop them.
FREEZE EVERYBODY!
Do you take out Dr.PotatoHead? Do you take out his thugs?
But you do not find him and with no one trying to stop him he is able to conquer the world. You are a poor excuse for a superhero!
THE END
HAHA!
SOUND
You decide the easiest thing to do would be to just take out Dr. PotatoHead himself.
NEXT CARD
POW!
You decide to take out his henchmen.
Good Choice!
NEXT CARD
SOUND

Nature Poems

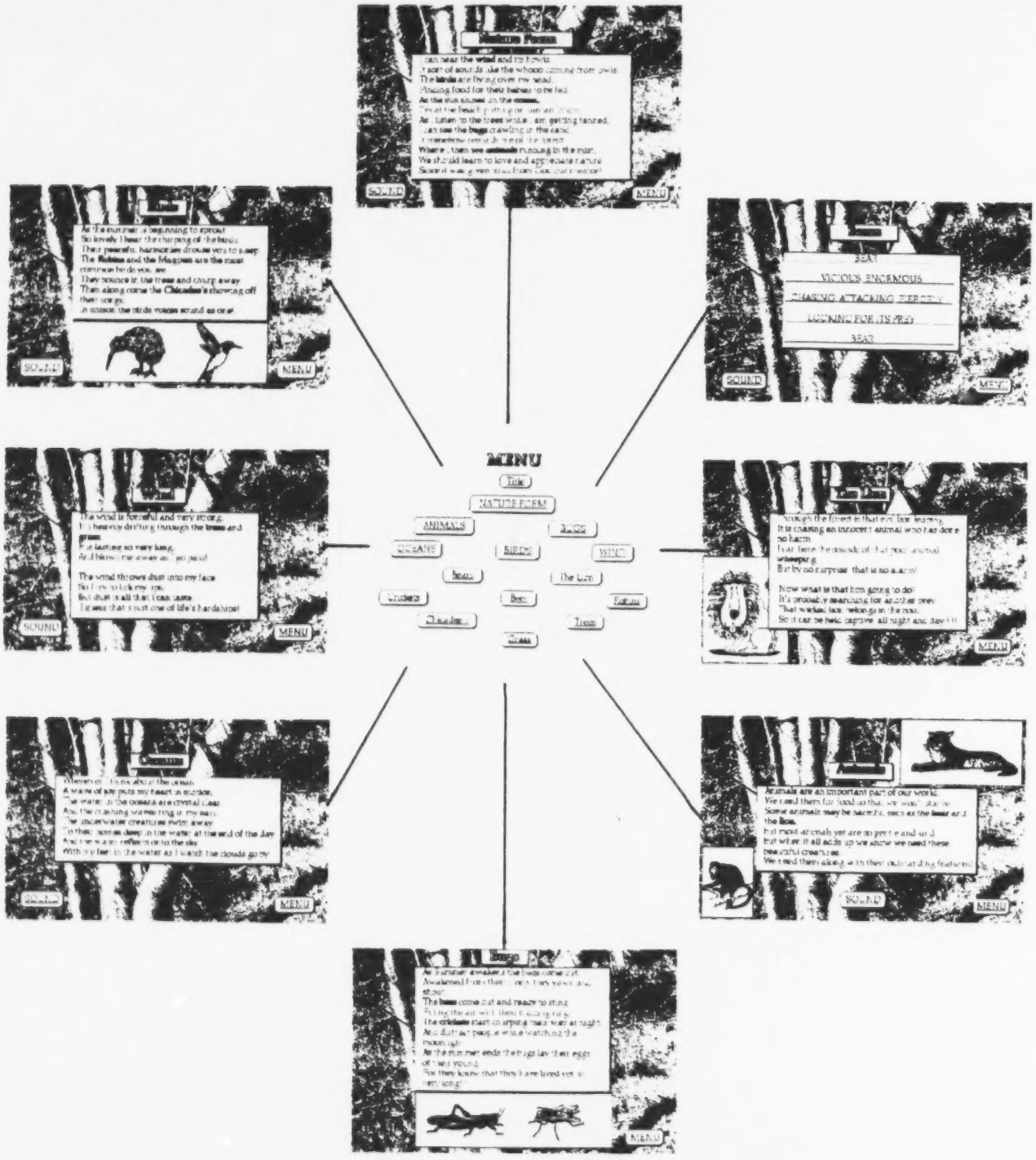
by Abigail Dy

My HyperCard project is on nature poetry. On each card I have a poem and some of the cards have some pictures on them. I have a background picture of a forest which came from HyperScan. The types of poems that I wrote are rhyming ones, ones without rhymes, Haiku, and cinquains.

First of all I made an outline as to how I was going to do it, and arranged my project in my journal. I looked for poems about nature in the library, but decided that I liked writing poetry too and so maybe I should write the poems instead of using someone else's. I made up one poem just to see if I could do a good job, and decided that my poems were just as good as the others because they were mine. My first poem was the nature poem, and it had in it all of the things that I wanted to write poems about. I thought that the other poems could be about things mentioned in the nature poem, and this was really good because then the whole stack was kind of complete and it made sense because it was all connected. After I finished my nature poem I started to write other poems, but I ran out of good ideas so I went back to the books I looked at before and used some of those poems because they were pretty good and they fit into my stack.

Then I started to work on the computer. I first designed my nature poem card. I found the neat background of the forest in HyperScan, so I decided to use that for my stack. I used fields for each of the poems so that you could see them. I typed in my nature poem, and decided to make the words that were poems in bold so you could choose to read those poems if you wanted too. Mostly I was just copying my poems from my journal into my stack, but once I was working away and I thought of a poem while I was working so I created a new card and quickly wrote the poem out. That poem sounded really good so I decided not to write any more poems out before I typed them into the computer. From then on I typed out my poems in the lab with help from Chan and Amy and Melissa. It was really neat and I really liked making the poems and then linking them together. One day I heard Norbert's stack that had music in it and I decided that I wanted to add sound, so I used MacRecorder and I recorded a whole bunch of neat nature sounds off a cassette that I borrowed from the downtown library. It was a lot of fun recording the sounds and then pasting them into my stack. I thought that I might record me saying the poems but then I ran out of time so I didn't get to do it. I think adding sound to my stack made it really special because it made it come alive. I also added Clip Art when I could find pictures that matched the poems. The last thing I did was make my menu card. I tried a whole bunch of designs but then I tried the diamond shape and I really liked it. I made the menu because after other people looked at my stack they suggested that maybe it would be a good idea to let people choose what poem they wanted without reading the nature poem. I thought

that was a good idea so I made a menu card. I was really happy with my stack, really proud because noone else thought of doing poetry and everyone thought that was really cool.

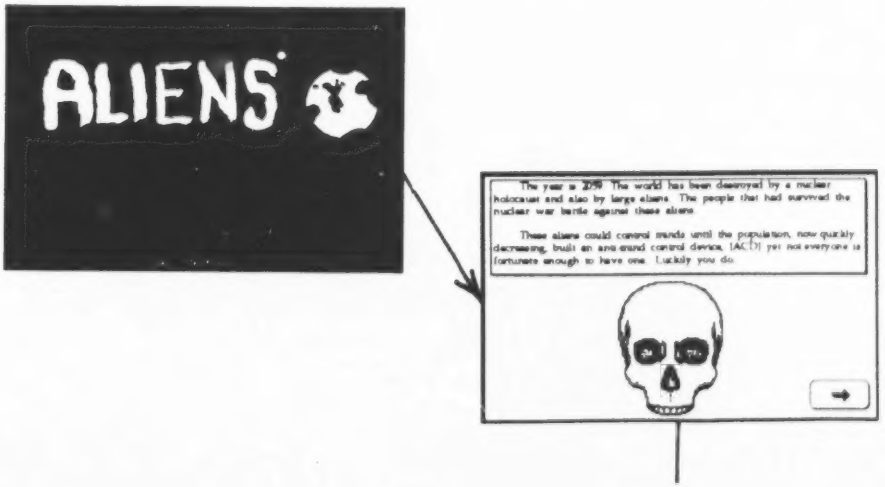


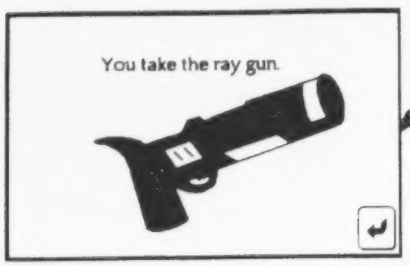
Aliens

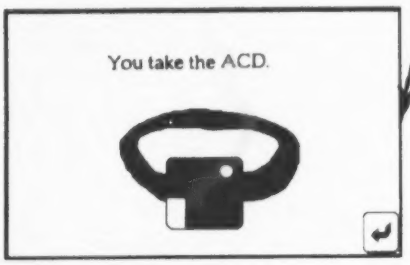
by Jared Peace

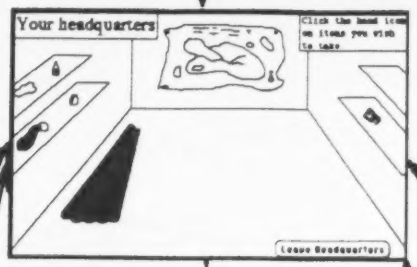
For my HyperCard project I chose to do it in the form of a Choose Your Own Adventure. You are a warrior in the future and the world has been over run by aliens. The whole story is the choices you make when living your life, and at the end if you make the right decisions you can win the game.

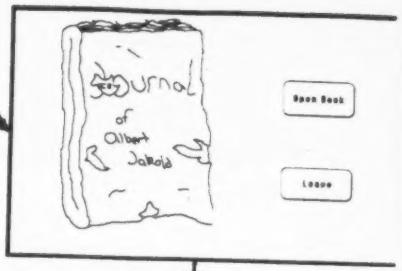
The first thing I did to design my HyperCard stack was to choose a topic. I decided to tell an interactive story about a future planet destroyed by a nuclear war and by aliens. Then I started working on my design document, figuring out the story line, text, graphics, and what choices the user will be allowed. I also decided what sounds to use, what and how to animate and figure out what the main characters would look like. When I was done this I drew where to put my buttons and fields. After my entire design document was complete I started working on the actual stack. I usually did 2 or 3 cards and then went back and pasted on my buttons. At first I used my design document all the time to figure out where I was going, but then I got new ideas and slowly I began to just figure out my story as I went along. I think this made it better because I got lots of good ideas in the lab from listening to other people and other people would read my stack and tell me things I could do better. I spent a lot of time drawing my people, and I used the graphics tools a lot, especially the Fat Bits option to add detail. Lots of times I would spend my whole lab time on one card, fixing up the pictures and making sure they looked just right. I never got bored because it was really important to me to do a good job, even though it didn't get marked and count on our report cards. I wanted to do a really good job, and it was a lot of fun. I finished the main stack and then made my animation. that was a lot of fun, although it took a lot of time. I would have added sound like Mike, but I decided to use all my time on animation. I really liked working in the lab and working on my stack. I was really pleased with the evaluations I got from everybody who saw my stack, and even though they didn't say I should change it, I went back through it a couple of times just to fix things up and make it a little better.


ALIENS
The year is 2059. The world has been destroyed by a nuclear holocaust and also by large aliens. The people that had survived the nuclear war battle against these aliens.
These aliens could control minds until the population, now quickly decreasing, built an anti-mind control device, [ACD] yet not everyone is fortunate enough to have one. Luckily you do.

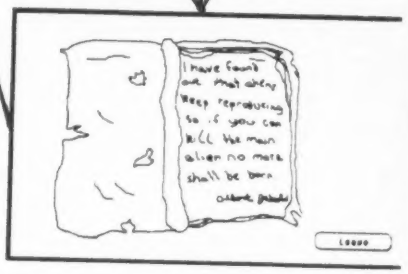

You take the ray gun.

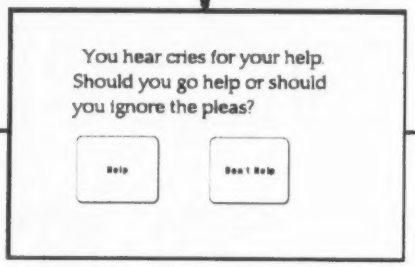

You take the ACD.


Your headquarters
Click the hand icon on items you wish to take
Leave Headquarters

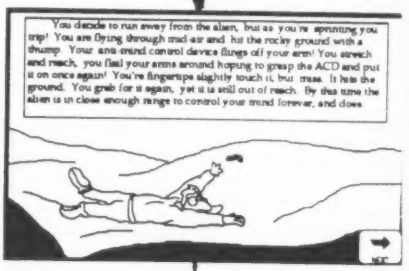

Journal of Albert Jakold
Open Book
Leave

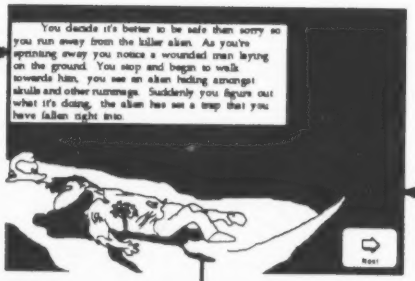
Outside of Headquarters
HELP!


I have found out that aliens keep reproducing so if you can kill the main alien no more shall be born
Albert Jakold
Leave

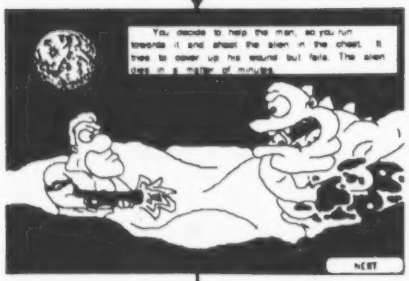

You hear cries for your help. Should you go help or should you ignore the pleas?
Help
Don't Help

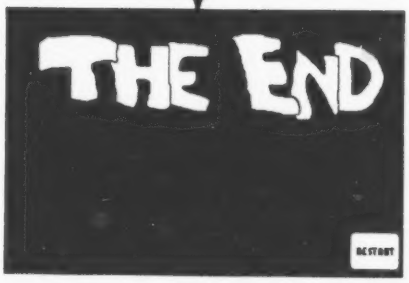
You begin to run towards the cries. You jog over all the hills of dirt, skulls, and rustwraps only to find the one in need of your help being attacked by a killer!!! What should you do?
Still Help
Run

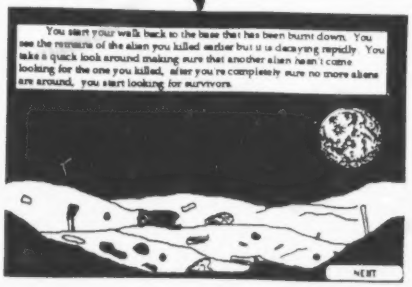

You decide to run away from the alien, but as you're sprinting you trip! You are flying through mid-air and hit the rocky ground with a thump. Your anti-mind control device flings off your arm! You screech and reach, you flail your arms around hoping to grasp the ACD and put it on once again! You're fingertips slightly touch it, but miss. It hits the ground. You grab for it again, yet it is still out of reach. By this time the alien is in close enough range to control your mind forever, and does
NEXT

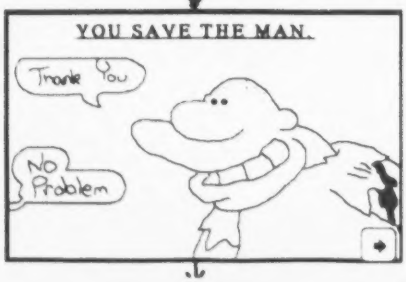

You decide it's better to be safe than sorry so you run away from the killer alien. As you're sprinting away you notice a wounded man laying on the ground. You stop and begin to walk towards him, you see an alien hiding amongst skulls and other rustwraps. Suddenly you figure out what it's doing, the alien has set a trap that you have fallen right into.
Next

You fire a shot at the alien yet only graze him. It starts running towards you, it jumps. What should you do? Should you stay and fight or should you run away?
Run
Fight


You decide to help the man, so you run towards it and shoot the alien in the chest. It tries to cover up his wound but fails. The alien dies in a matter of minutes
NEXT


THE END
RESTART


You start your walk back to the base that has been burnt down. You see the remains of the alien you killed earlier but it is decaying rapidly. You take a quick look around making sure that another alien hasn't come looking for the one you killed, after you're completely sure no more aliens are around, you start looking for survivors.
NEXT


YOU SAVE THE MAN.
Thank You
No Problem

Time Machine

by Derek Czarnota

For my HyperCard project I decided to make an interactive story. It's about a guy who finds a time machine device and either goes to the past or the future. In the past you can go to about 4 different places trying to overcome little obstacles. If you go to the future you have to try and save the world from aliens.

When Mr. Kemp told us that we could do any kind of project on the computers in HyperCard I right away decided to do an interactive story. I didn't even think about doing a report or anything like that because I really wanted to try an interactive story.

At first while I was flipping through the graphics I found a man I wanted to use in my story. He was going to be a scientist that studied ghosts in cemeteries. I thought about it some more and then decided that that wouldn't make a good enough story so I dropped it.

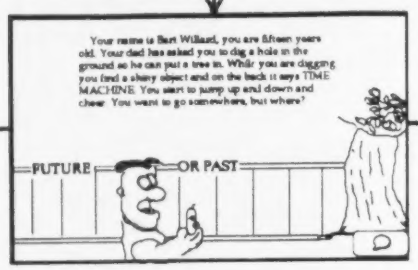
Then one night while I was in bed I remembered a story I read that was about time travel. I wanted the story to have some things people knew about. For the first half (past) of my story I decided that the person in my story should meet Billy the Kid, see a championship game of any sport, and to see President JFK get killed.

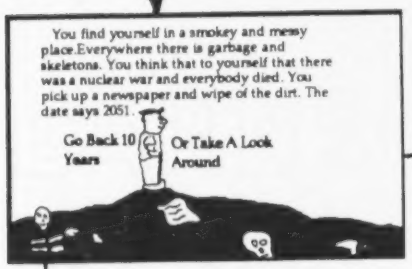
After that I described which each card would be about on recipe cards like we used for the encyclopedia project. Then I planned out each card on paper exactly the way I wanted them to be on computer, the cards worked really good because I was used to using them from before, and I knew how much stuff you could fit on the screen by making it fit on the card. It also helped because I could put the cards down on the floor in the right order and see how the story would go. Sometimes I didn't like the way the story was going so I switched cards, and sometimes I saw that one way was sort of short so I decided to make it better. That really helped me to plan out my story.

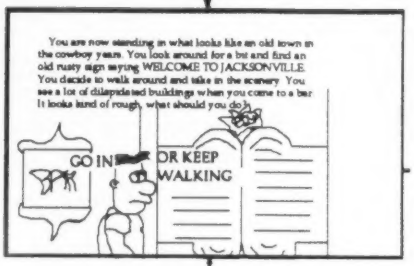
After that I started to work on the computers. I did all of my writing in fields, and I chose Palatino 14 for my print style and size. I did all of my pictures with the pencil, straight line, circle, and paint can. On the fifteenth card I changed my writing to Palatino 18 because I thought that it looked better. When I was done, I linked all the cards together with buttons. Then I went back and read through the first part to see if it was any good. I got some of my friends to read it, and they liked it, but there were some spelling mistakes so I fixed them up.

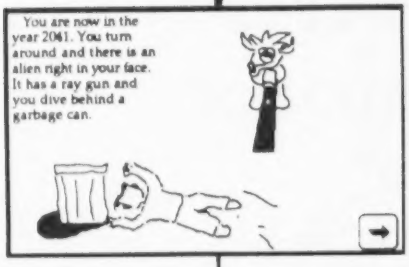
For the second half of my story (future) I planned out the whole thing on cards again because that really worked good. I did the same things using drawing tools and I stayed with Palatino 18. I got the idea of using aliens from Jared's stack because I had seen his stack and it was really cool so I used his idea of aliens. He said that was okay. The last part of the stack went really quick for me because I had the plan and I was used to HyperCard.

TIME MACHINE
By DEREK CZARNOTA

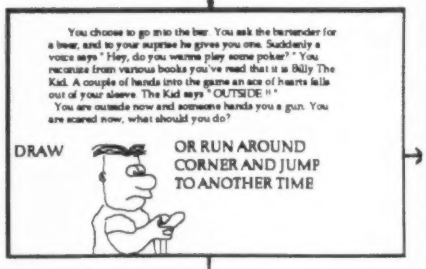

Your name is Bart Willard, you are fifteen years old. Your dad has asked you to dig a hole in the ground so he can put a tree in. While you are digging you find a shiny object and on the back it says TIME MACHINE. You start to jump up and down and cheer. You want to go somewhere, but where?
FUTURE
OR PAST

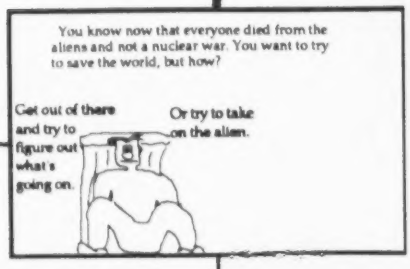

You find yourself in a smokey and messy place.Everywhere there is garbage and skeletons. You think that to yourself that there was a nuclear war and everybody died. You pick up a newspaper and wipe of the dirt. The date says 2051.
Go Back 10 Years
Or Take A Look Around

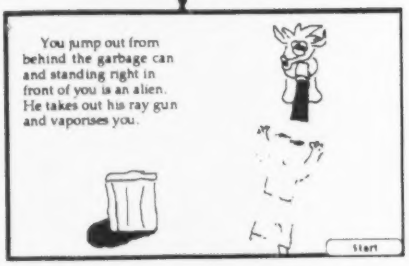

You are now standing in what looks like an old town in the cowboy years. You look around for a bit and find an old rusty sign saying WELCOME TO JACKSONVILLE. You decide to walk around and take in the scenery. You see a lot of dilapidated buildings when you come to a bar. It looks kind of rough, what should you do?
GO IN
OR KEEP WALKING

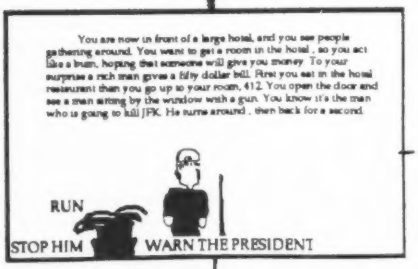

You are now in the year 2041. You turn around and there is an alien right in your face. It has a ray gun and you dive behind a garbage can.

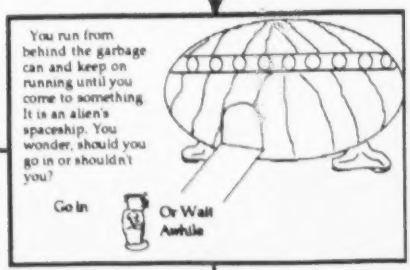
You have made a big mistake by taking a look around. There is an alien behind the ridge and he takes you to another planet and takes you forever.
Start


You choose to go into the bar. You ask the bartender for a beer, and to your surprise he gives you one. Suddenly a voice says " Hey, do you wanna play some poker? " You recognize from various books you've read that it is Billy The Kid. A couple of hands into the game an ace of hearts falls out of your sleeve. The Kid says " OUTSIDE !! "
You are outside now and someone hands you a gun. You are scared now, what should you do?
DRAW
OR RUN AROUND CORNER AND JUMP TO ANOTHER TIME


You know now that everyone died from the aliens and not a nuclear war. You want to try to save the world, but how?
Get out of there and try to figure out what's going on.
Or try to take on the alien.


You jump out from behind the garbage can and standing right in front of you is an alien. He takes out his ray gun and vaporises you.
Start


You are now in front of a large hotel, and you see people gathering around. You want to get a room in the hotel , so you act like a bum, hoping that someone will give you money. To your surprise a rich man gives a fifty dollar bill. First you eat in the hotel restaurant then you go up to your room, 412. You open the door and see a man sitting by the window with a gun. You know it's the man who is going to kill JFK. He turns around , then back for a second.
RUN
STOP HIM
WARN THE PRESIDENT


You run from behind the garbage can and keep on running until you come to something. It is an alien's spaceship. You wonder, should you go in or shouldn't you?
Go In
Or Wait Awhile

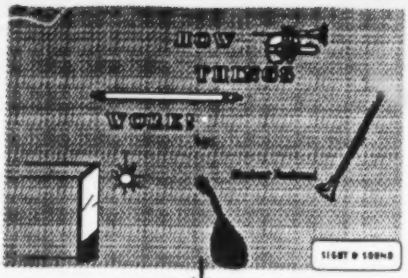
How Things Work

by Norbert Rachwal

My project is called "How Things Work". I got all of the ideas and information from a book I was reading. I have 6 chapters in my stack which explains how two way mirrors, string guitars, trumpets, clarinets, oboes, and fluorescent tubes work. I chose to do things that could have sound in them because I wanted to use sound in my stack, so that's why I chose the musical instruments.

Well, as I said above, I chose to do a stack on how things work because I was reading a book at the time that we finished the multimedia encyclopedia. I also thought about doing an interactive story but lots of people were doing that so I wanted to do something different. I also thought about what I could do that had sound, and then I thought of this book and how I could add sound to the instruments. I read through the book a few times and began to design my stack out in my journal. I also began to look through Clip Art and for music that I could use, and that's how I chose the instruments because I had Clip Art and music to go with them. I drew out my cards in my journal just to sort of get an idea about how they would look. Tyler really helped me because he was doing a stack on music, so we sort of worked together and we shared ideas. I planned out every card before I started on the computers. I didn't have a lot of cards, but I put a lot of work into each card so I thought that was okay.

While I was writing on the computer I would draw a picture first, and then work the writing in afterwards. I took a long time to draw my pictures because they were important and I wasn't very good. Tyler was great at drawing so he helped me on my fluorescent tube. I recorded my sounds as I went along, so I would finish a card before I would go ahead to the next one. But lots of times I would get a new idea, I hate that. You're in the middle of doing something and then this new idea hits you, BANG! And you have to start all over, even right now while I'm writing, or go back to a card before your idea dissolves, and then get back to the card you were working on and continue where you left off. I wish I wouldn't get new ideas all the time because it's a pain, but then after you're all done you look back and think that maybe it is better this way so it's not so bad being interrupted with new ideas. I guess the part I enjoyed the most was when other people got a chance to look at my stack and they really liked it. I was really proud and I felt really good about myself. I had a lot of fun and I worked hard and this was harder than the other subjects but I did better because I had more fun and I didn't mind working on it. I even worked on it during recesses and after we ate lunch and whenever there was a free computer I would always ask to go on. I would really recommend HyperCard to everyone because I think it's great.



Sight and Sound

In this chapter I will talk to you about a few things which include a ○ two-way mirror ○ a string guitar ,○ a trumpet ,○ a clarinet, ○ the oboe and the ○ fluorescent tube

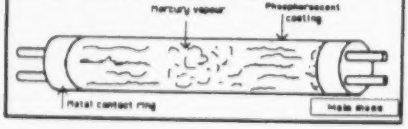
Please click on your topic

Fluorescent Tube

Romantic though candle light and gaslight may be, the development of light by electricity has transformed our indoor world into a brighter environment. The electric lightbulb is a relatively recent invention; Thomas A. Edison developed the first commercially practical incandescent bulb in 1879.

Main menu | Continue

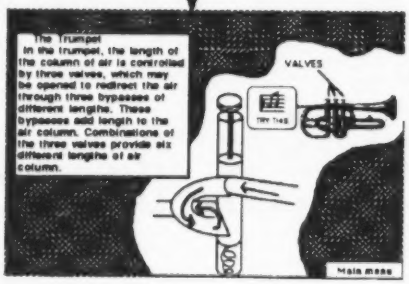
The fluorescent tube is more efficient than the bulb. It not only gives off much less heat, but the same light output can be had with lower bills. The fluorescent tube is filled with mercury vapor. This allows electricity to flow between the metal contact rings at either end of the tube. The mercury vapor produces invisible ultraviolet light when current flows through it. The ultraviolet rays strike a phosphorescent coating on the inside of the tube, which then glows brightly. The original fluorescent tubes produce a cold blue light; later variations in the phosphors produce warm color.



Main menu

The Trumpet

In the trumpet, the length of the column of air is controlled by three valves, which may be opened to redirect the air through three bypasses of different lengths. These bypasses add length to the air column. Combinations of the three valves provide six different lengths of air column.



Main menu

Stringed Instruments

Violins, Guitars, and other stringed instruments produce sound by the vibration of a taut string. A vibrating string alone does not make a sound that is very loud. To make the sound louder, the strings are connected to a sounding board that vibrates driven by the strings. They can be set in motion by plucking them with the fingers, by striking them, or by rubbing them.

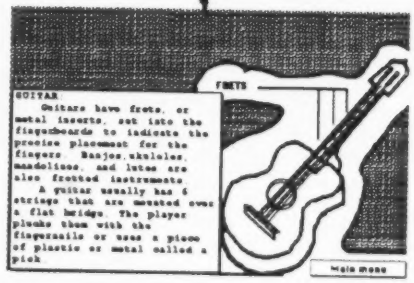
The vibrating strings produce a tone at its natural frequency, called the pitch. This pitch depends on the length of the string, its weight, and its tautness. A short, tight string will produce a higher tone than a longer, looser one. By pressing down on a string with your finger, the string is temporarily shortened, and it will sound a higher note than it does when its full length is vibrating.

Main menu | Continue

GUITAR

Guitars have frets, or metal inserts, set into the fingerboards to indicate the precise placement for the fingers. Banjos,ukuleles, mandolines, and lutes are also fretted instruments.

A guitar usually has 6 strings that are mounted over a flat bridge. The player plucks them with the fingernails or uses a piece of plastic or metal called a pick



Main menu

The Two-way Mirror

Ordinary mirrors are sheets of glass coated on the back with silver or another highly reflective metal. Two-way mirrors have only a thin coat of reflecting metal on the back. If you look at the mirror from the front, you will see your own reflection; but the person behind it can see through it. Why?

Main menu

Answer: Although the light rays reflect on one side of the mirror, they penetrate the thinly coated side to reach the darkened room.

Main menu

WIND INSTRUMENTS

A variety of musical instruments use the pressure of air to make a musical sound. For most of them, you produce the air pressure by blowing into a metal or wooden tube in which the enclosed column of air is set vibrating.

Main menu | Continue

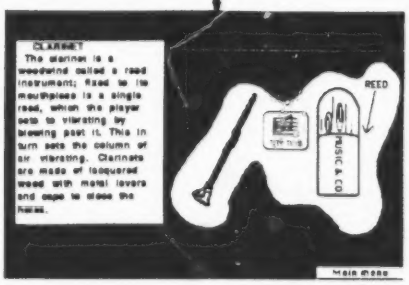
The Oboe

The oboe is the smallest of the family of double-reed woodwinds. The two reeds are held tightly between the player's lips and vibrate toward and away from each other when the player forces air between them. Larger members of this family include the English horn and the Bassoon.

Main menu

CLARINET

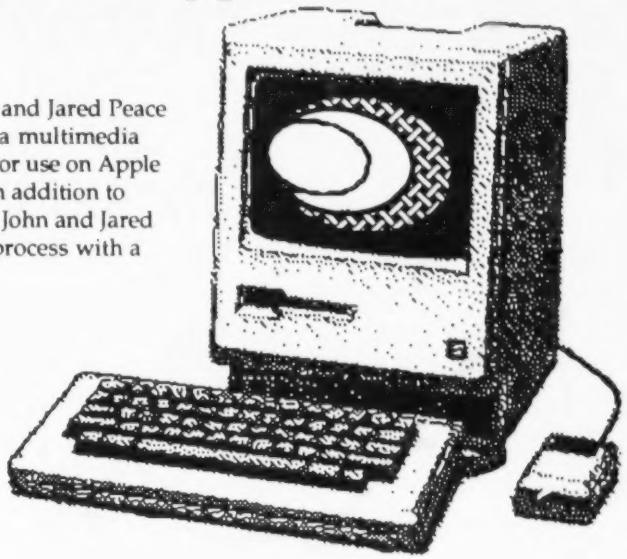
The clarinet is a woodwind called a reed instrument; fixed to its mouthpiece is a single reed, which the player sets to vibrating by blowing past it. This in turn sets the column of air vibrating. Clarinets are made of lacquered wood with metal levers and caps to close the holes.



Main menu

Software Review: HyperCard

Abstract: John McGrath and Jared Peace review HyperCard 2.0, a multimedia authoring environment for use on Apple Macintosh computers. In addition to describing the program, John and Jared describe the authoring process with a sample composition.



In the computer program, HyperCard, you can make a stack of cards, cards are a computer screen. After you have designed and finished, you link them all together with buttons. These buttons let you join cards together, for example, in a Choose Your Own Adventure type of story, or maybe in an encyclopedia on a topic. Each card can have text or graphics. Text is written in fields, while graphics can be copied from Clip Art or drawn free-hand. To use HyperCard, you have a hand, called the browse tool. This lets you choose different buttons.

There are many graphics tools available in HyperCard. The pencil icon lets you draw free hand, while the paintbrush icon is just the same as the pencil only with different shapes and sizes of lines. The eraser icon erases anything on the screen, just like in MacPaint or MacDraw. The lasso icon or the shimmering box enables you to move a graphic into a different place on the screen, or select a graphic for copying, and the paint can fills in an area with a pattern that you select.

Buttons are the coolest things about HyperCard because you can put lots of buttons on one card, and then link cards so that the buttons take you to many different places. That means that you don't have to make presentations that just go from one card to the next. In HyperCard, buttons can connect cards for lots of different reasons like giving more information, or explaining something, or showing animation, or sound effects, or making choices. This is good because you can make interactive stories or, presentations, and the reader can

choose his fate. You can choose different effects to put with the buttons. There are 22 different effects to choose from such as dissolve, and four speeds of effects. On the button, you can type words, put an icon, or even edit and change an icon. The button size and shape can be easily changed by clicking and holding on the corners. Buttons are moved by clicking and holding on the middle of them. There are 7 different kinds of buttons. Jared and I prefer the shadow, but icons are really neat too.

Another option you have in HyperCard are fields. Fields are a box that you can type in. You can change the type of field from transparent to opaque, rectangle, shadow or scrolling. You also have options such as locking the text or showing the lines under the text. With a field you can change the fonts from 7 different types each with different sizes from 12 to 24, and you also have choices of the style as with any word processor. You can change the fonts or style whenever you want. You can also change the field size or where you want to position it on the card. After you create a field by pulling down the Objects menu and selecting new field, you then go the Field info to select the style of the field. To enter text into the field, you have to select the browse icon, the hand, and then you click inside the field and begin to type. Fields are only for text. If you want to put a graphic on a card, you just paste it into either the background or the foreground.

Another neat thing you can do is animation. Animation works by opening a new stack, and then drawing a picture and moving it slightly on the next card. You do this until your entire animation sequence is done. After that you link this new stack to your original stack with a button. When you click on that button in your original stack it takes you to your new stack and the animation sequence.

Something else that is really neat is sound. You can have computer sound like HyperMacintalk which sounds like a robot, or you can have a sound you've previously recorded using MacRecorder and a microphone. Using MacRecorder, you can add your own voice or sound effects and it digitizes the sound and then you can go to a sound editor and cut and paste sounds just like you cut and paste text in a word processor. Then you paste your sounds into your stacks and it makes a button. When you choose the button, the sound is played back.

These are the most important things about HyperCard.

The authoring process in HyperCard

In HyperCard, we started by making a new stack and drawing the picture for the first card. We used the circle drawing tool for the man's eyes and the pencil tool for his face. We zoomed in with fatbits by double clicking the pencil tool to tidy up the details. Then we opened a Clip Art stack and copied a caveman body to the clipboard. We then returned back to our stack by pulling down the Go menu and choosing Recent. We then got a series of small versions of our cards, and we clicked on the card we wanted to return to. We pasted the picture onto the first card and modified it by circling a raised arm with the lasso and flipping it vertically and horizontally. We also erased the

Figure 1: The HyperCard stack

little men on the graphic by using fatbits and the pencil. We took the lasso and moved our caveman to the bottom right hand corner. Next we got the paint brush and wrote a title by clicking and holding on the mouse button. After that, we filled in the bottom of the screen with the spray can icon. Then we drew a dinosaur in the background and zoomed in to tidy up. Next we made a cave by using the pencil, paint brush, and paint can.

For the next card, we got a field, changed the size and font to Palatino 14 by pulling down Edit and choosing Text Style. Then we typed a beginning story inside. After that, we went to the first card and took the picture of the caveman, copied him and put him on the second card. We flipped the caveman so he was facing the left, then we changed his eyes. Then we drew some ice using the pencil icon.

For the third card we started by making a new field and going to Field info under the Objects menu. We chose to have a shadow field and Palatino 14 as a font and size. Then we got the hand tool and clicked at the top of the field. Next we typed in the text. After that we copied the original caveman head we drew and pasted it onto the card beside our field. Then we Opened Stack and circled a graphic in the Art Bits Clip Art with the lasso and copied it. We pasted it on our card and added it to our head. We drew glasses with the pencil, and moved his eyes over with the lasso. We also flipped his head horizontally. Then we Opened Stack again to get a puppy from Clip Art and we pasted it in by pressing command V. We made a new card by pressing command N.

On the next card we copied then pasted the picture of the man wearing a suit. We then went to Objects and got a new field, then we went to Objects again and went to Field info and changed the field style to shadow. We went to the hand icon and clicked inside the field. We then typed "Steve then decided that he needed a last name. He asked Ben for a suggestion. The puppy sneezed and Steve thought that he said, "Kemp-choo!", so he was going to call himself Kemp-choo. Then Steve was looking in the phone

book because he wanted to order a pizza, and he saw that somebody already had the last name, Kemp-choo. Steve didn't want to have the same last name as somebody else, so he changed it to Mr. Kemp!"

Next we went to Classroom Clip Art and got a picture of a student using the lasso. After it was copied we went to Go and Recent to get back to our stack. We pasted 5 pictures of the students in the blank areas of the screen.

On the next card we typed, "Mr. Kemp taught Grade 8 at Bishop Pocock School" in Palatino 24. After that we wrote The End with a paint brush. Finally, we went to the start and added buttons to all the cards.

Likes and Dislikes

Jared liked everything about HyperCard except that you can't zoom in as far as you can in MacPaint. John also liked everything, but he didn't like it when he drew a picture with the pencil, and then pasted a graphic from Clip Art over top and accidentally clicked somewhere else because then it was stuck. We also sampled all of the students in the class, and asked them for their reactions to HyperCard. Here are some of them:

> Using HyperCard was much better than other programs because it had so much more Clip Art and that saved me time and effort on my project. I also liked that you can flip your picture over horizontally, that came in handy when I wanted to change the way people in my project were facing. I like that it had fatbits and you could zoom in and touch up your picture that way. I like that HyperCard saved your stack so I didn't have to remember. Finally, I liked best of all the Recent option so you could just go back from where you came from. There wasn't anything I didn't like. (Jason)

> In HyperCard, I liked using lots of neat things like the buttons (how they bring you to a card which you want to see), the fields (how you can change the style and shape and change the print inside), and the graphics, because there is lots of really neat ones. I also liked the way you can add backgrounds and it stays there on every card. HyperMacintalk was okay but MacRecorder and the scanner were really neat. The thing I didn't like about HyperCard was the way it always saved your work. Sometimes it saved my mistakes and I had to re-do the whole card. (Norbert)

> I liked most the interactive form of displaying your stuff instead of PowerPoint's slideshow form. It was a lot more fun thinking up things that people could do when they were using your stack. I didn't like using the Clip Art because it was very time consuming finding your pictures, and I wasted a lot of time just flipping through the stacks. (Michael)

> I loved HyperCard, because you can link cards together using buttons to create a story. Another good option is being able to add sound and animation to your stacks. I didn't like HyperCard because we only had black and white screens, and I didn't like only having one zoom instead of closer and closer zooms like in

MacPaint. (Abigail)

I liked HyperCard because it has a wide selection of graphics. I also liked the scanner and especially MacRecorder. It was really fun putting sound into your stacks. I also liked the buttons that let you join the cards. It was much more interesting and challenging trying to come up with neat ways to join everything together, and then sometimes you could just add on or keep going with an idea that was connected or just too big to fit on one card. I liked that you could distort and change pictures to the way you liked them. I didn't find anything I didn't like about HyperCard. (Derek)

I liked HyperCard alot because of all of the neat things you could create. Everytime I worked in HyperCard I was always thinking of really neat ideas to do. I also liked the buttons. Buttons are little pictures that you can use to join the cards together. You can even make the buttons invisible and put them over pictures. What I didn't like about HyperCard was that sometimes I forgot what I was doing and why I was doing it. Sometimes I had to go back over my stack to figure out what I was doing. It was hard sometimes keeping all of your ideas straight. (Kate)

I liked HyperCard because you could pick any thing to write about and HyperCard would have lots of things in it to help your report look better. It even had sound which was really awesome. HyperCard takes a long time to do, which is bad, but I was never bored, and even though it took a long time, I couldn't have done anywhere near as good without it. (Amy)

You can tell from these comments made by the people in our class, and the way we told this article that we all think that HyperCard is great. The most important things about HyperCard are the buttons which let you join cards together in really neat ways. We also really liked the graphics tools and the field options for putting in text. We especially liked the way that you could animate things by copying them onto the next card. Perhaps the best thing we found with HyperCard was the way that you could add sounds. They made making a stack a lot of fun, and something totally new and different.

Reviewed by: John McGrath
and Jared Peace

Software Review: MacRecorder

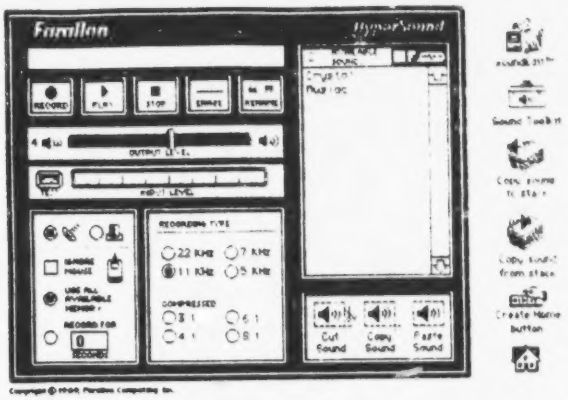
Abstract: Abigail Dy and Derek Czarnota review the sound generation and editing application, MacRecorder.

MacRecorder really helped my HyperCard project. It allowed me to put sound into my stack to make it more interesting and amusing. MacRecorder is a program that you put into your computer, and as well it comes with a microphone that you attach to the back of your computer.

The screen that I used to make the sound on has choices to click on. For example, you can choose from Play, Stop, Record, Rename and Erase. There is also a test button that shows you if the recorder is picking up your sounds. You can adjust the volume using the slide that you see in the middle of the screen. On the right hand side are some icons that let you edit your sounds. The top option, SoundEdit, is a really neat program that lets you cut and copy sounds. The sounds that you record are displayed on the screen as a whole bunch of spiked lines, and you can replay any part of the sound that you want. Then, using the highlight bar like we do in word processing, you can select certain sounds and cut and copy and paste them to create your own sounds.

To record the sounds I wanted, all I had to do was click on record and then it let me click on either cancel or record. If you are recording, it will give you a certain amount of time to record your sounds, but it leaves you a pretty long span of time. When I recorded on the Mac SE, I had 134 seconds of recording that was possible. When you are finished recording, you simply move the mouse and it will stop recording. You also get to select the level you want for volume.

You get a code number for every sound, so when you want to get ride of what you had finished recording, you just click on erase and it will cancel the



sound and give you a new code number for the next sound.

MacRecorder can tape almost any kind of sounds. You can tape your own voice or sound effects by simply talking or making the sound effects into the microphone or you can play a tape in a ghetto blaster and put the microphone up against the speakers. You have to be very quiet when you are doing this or it will record the noise in the background. MacRecorder also comes with cables that let you connect a cassette machine with the recorder so you don't get the background noise.

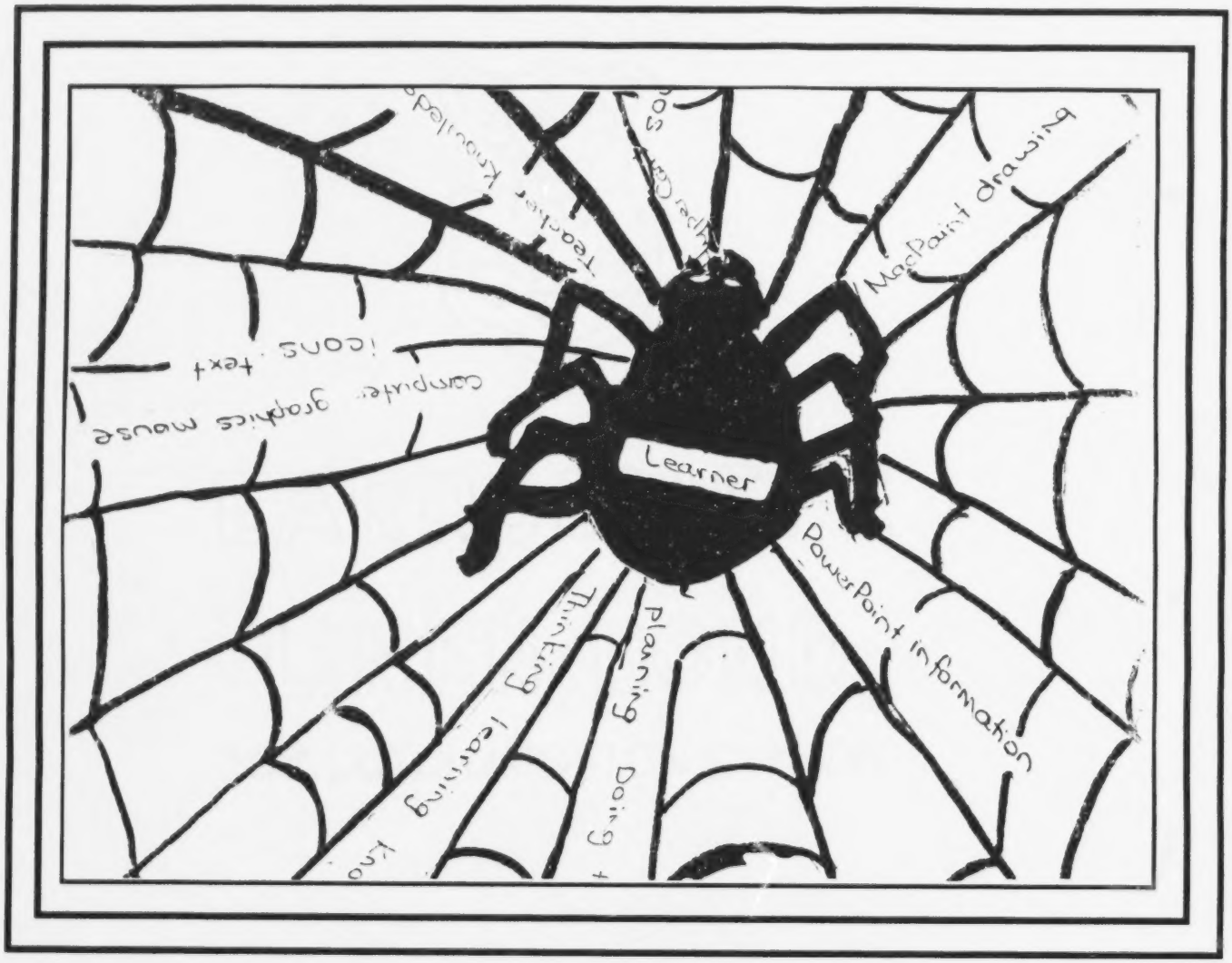
Once I had recorded my sound, I clicked on the code number, and then I double clicked on the icon "Copy sound to Stack". It then took me to the window Authorware, and from there I kept on clicking on drive until I got to my station disk where I had saved my stack. When I opened my stack, a message was displayed that said, "Select destination card and paste". I used the arrow keys on the keyboard to move to the card I wanted to paste the button on, and I went to the Edit menu and I pulled down Paste Button. A button appeared with the code number of my sound, and I then went to Button Info under Objects to change the size, name and font that I wanted for my button. There is a really neat icon that you can use to show sound, so instead of using a button name I chose to use an icon that showed a person's head with a balloon, just like in the comics. From there, all I had to do was to go to the Tools menu, select the browse tool, the hand, and then click on my button. My sound played itself. All of the above is the process of getting your sound to your stack which takes no time at all.

MacRecorder was very fun to work with and was a really good experience for improving our stacks. It really made computers much more interesting and enjoyable for me. It was amazing hearing all the sounds that I had pasted into my stack. The sounds were really clear, and sounded just like the originals. MacRecorder really brightened up my HyperCard project and I sure would enjoy being able to use it again in the future.

Reviewed by: Abigail Dy

The medium

An inquiry into the nature of the authoring experience in a computing medium



In this issue: ***The nature of multimedia authoring***

November , 1992 Volume 3, Number 1

The medium

An inquiry into the nature of the authoring experience in a computing medium

November, 1992 Volume 3, Number 1

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The aim of ***The Medium*** is to provide a forum for discussion and debate concerning the nature of the authoring experience in a computing medium. It is the contention of the author that computer-based, multimedia authoring environments constitute a qualitatively different experience as an authoring medium. It is to the description and interpretation of the nature of this authoring experience that this journal, as an on-going narrative of research conducted as partial fulfillment for the degree of Doctor of philosophy, is dedicated.

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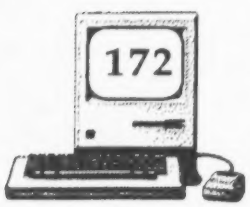
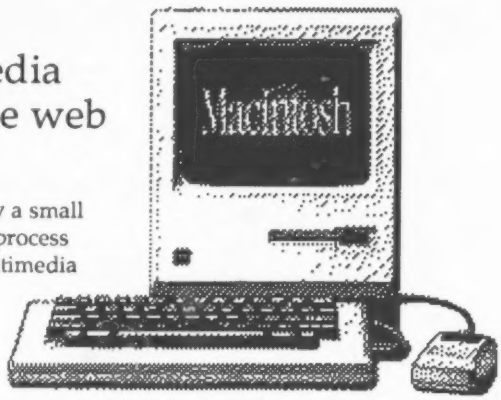
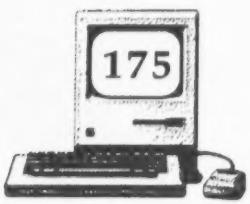


The nature of multimedia authoring: Spinning the web of meaning

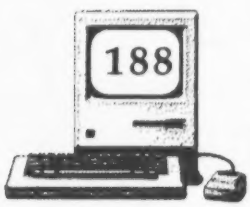
Abstract: Using a metaphor employed by a small group of students, this article begins the process of trying to understand the nature of multimedia authoring.





Understanding the process of teaching

Abstract: This article describes the elements, processes and relationships in the process of teaching. A paradigm will be developed which will look at the medium of teaching, the messages which emanate from that medium, and the meaning of those messages. A paradigm of the nature of the teaching process will be developed, incorporating the work of Erik De Corte (1990), and using examples from the comments of elementary school students as well as my reflections of the roles I played during that process.



Understanding the process of multimedia authoring

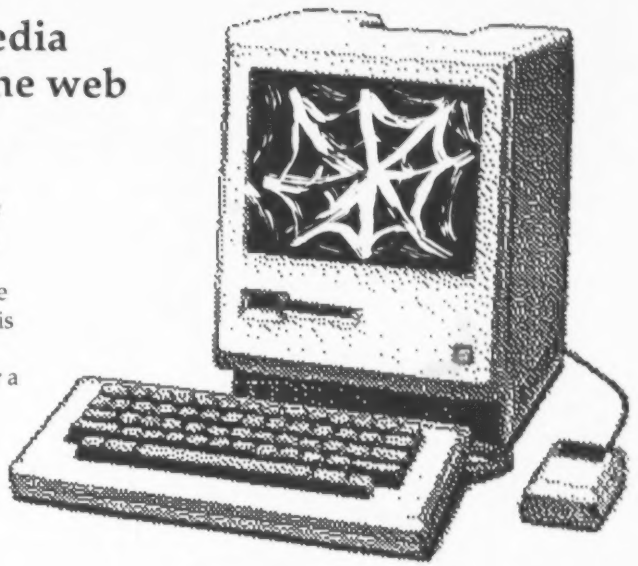
Abstract: This article describes the elements, processes and relationships in the context of computer-based, multimedia authoring environments. A paradigm will be developed which will look at the medium of multimedia authoring, the messages which emanate from that medium, and the meaning of those messages. Specific examples of each will be presented from the compositions of the students of Bishop Pocock School in Saskatoon, Saskatchewan.

Understanding the nature of the research process

Abstract: This article describes the elements, processes and relationships in the process of research. A paradigm of the nature of the research process will be developed, incorporating the point of viewing of a Taoist cosmology with naturalistic inquiry.

The nature of multimedia authoring: Spinning the web of meaning

Abstract: The metaphor suggested by the ecological model of education is that of a web, in which anything that affects one strand of the web vibrates throughout the whole (Marilyn Cooper, 1986, p. 370). This article describes the meaning that the process of multimedia authoring held for a group of Grade 8 students.



The medium: Okay, you've drawn a spider spinning a spider web. What does it mean?

Abigail: Well, the spider is us, the learners, and we're making a spider web that is everything that we've done and learned.

The medium: You're making the web, this is the learner making something which joins together everything that you've been working on?

Chantel: And as we learn more and more things, then the web gets bigger. We didn't know how the spider spins his web, you know, Do they start off with one strand and then string the others or what?, but we thought that what was important was how it looked, you know, with all these things connected together.

The medium: How did you think of that? Who came up with the idea?

Claudia: I did, and then we all sort of agreed. I don't know how I got the idea, maybe just because I was thinking of a way to join all these things together and to show that it got bigger and better, and then I just thought of a spider web and I said it.

The medium: So you were looking for something that could show how all of these aspects here were connected, and then how once you joined them that it got bigger and began to grow, is that right? (General agreement from the group) Now you've got groups of information here, you've got MacPaint and drawing, you've got PowerPoint and information, you've got computer, graphics, mouse and so on, what's the reason behind grouping them in that way?

Chantel: That's what we did when we used those programs.

The medium: I see, and HyperCard and sound, menus, animation and authoring was all part of HyperCard. What are you saying about teacher, knowledge and reflection?

Chantel: You, the teacher, had some knowledge about the computers and once you gave us that knowledge then we started spinning the web (laughing!).

The medium: What about reflection? Did I encourage you to reflect back on what you had done?

Claudia: Whenever we wrote in our journals then we would think back, we would replay the thing over, and that's reflecting, right?

The medium: Tell me about planning, doing and so on.

Abigail: These are the things that we would have done, mostly on our own, but sometimes with our groups, and sometimes you.

The medium: I like the way these, these strands that connect the web together, the main strands, I love the way they bring everything together.

Melissa: That's to show that all of these are connected. We wanted to show that you couldn't just do one thing alone, that we sort of joined all these together.

The medium: Is the inside word important, for example, I notice you've got MacPaint in the middle and drawing coming out of MacPaint. Did you do that on purpose?

Claudia: Yes.

The medium: So what about planning, doing, teaching, and so on, are they in order?

Melissa: Kinda, they were in the order that we thought most times we would do them, but sometimes that didn't happen, but most times this is the way it was. The order was thinking, then learning then knowing. But some of these words just don't belong here.

Claudia: Yeah, like menus belongs everywhere, and so does information, and text.

The medium: What about reflection?

Chantel: That's in all of them too, because you're always going back to them or thinking about them, like sometimes after I drew a picture I had a new idea, and sometimes more information, and then I would change what I was going to do. Sometimes, like after PowerPoint, when we thought back on what we did, and stuff, I used a lot of that in HyperCard and it really helped, because I'd never kind of kept on using what we had already taken, like most times we would do something and then just leave it and not worry about it anymore, but this year we always kept thinking back and kept using what we already had done to make the new stuff easier..

Abigail: ...and better, like everything I did got better because I kept on using what I already knew, so it made it easier.

The medium: What about you as a learner, is this something different?

Chantel: Yeah, because I improved on my mistakes. But it's the same in other stuff too, like in Math we always keep going back, and the same in social and science, right?

The medium: Well, I like to think that everything is connected, and that's why I enjoyed your spider web so much, because everything was connected. Anything else, ladies? No? Thanks, that was terrific, I really enjoyed our discussion.

Spinning the web of meaning; a metaphor created and constructed by one group of students in trying to describe the meaning that their experience with multimedia authoring held for them.

I have selected this transcribed dialogue between the students and myself because it is so apt and appropriate for the theme of this issue of *The medium*. I too was looking for a metaphor that would describe my experiences, not only in using one particular computer application, but also to begin to understand the nature of the entire year that I spent with my students. Spinning the web of meaning is, for me, the ecology of teaching and learning and researching, the nature not only of education, but also that of the authoring process, Languaging, the nature of Being, and Doing, and Knowing, and Understanding.

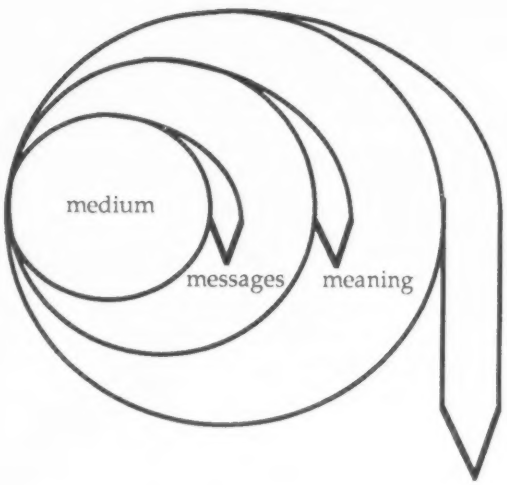
In this issue of *The medium*, we will explore the broader context of meaning in education, looking at the nature of the authoring process to be sure, but also at the nature of teaching and learning and researching. Thus the nature of the medium changes, and as it does, so necessarily must the nature of the messages which emanate from the medium, and the nature of the meaning of *The medium*.

Stephen Kemp,

Editor.

Understanding the process of teaching

Abstract: This article describes the elements, processes and relationships in the process of teaching. A paradigm will be developed which will look at the medium of teaching, the messages which emanate from that medium, and the meaning of those messages. A paradigm of the nature of the teaching process will be developed, incorporating the work of Erik De Corte (1990), and using examples from the comments of elementary school students as well as my reflections of the roles I played during that process.



The standard definition of teaching often connotes the idea that there is a transmission of information from one discrete entity, a teacher, to another discrete entity, a learner, to bridge a gap in Knowing between them. From this point of viewing, teaching is a conduit through which information passes from the instructor to the learner. When one teaches, one gives to someone else something that they did not have before, it is then, a "deficit" model. The role of the teacher is that of the manager of the instructional setting, the designer of the most efficient and effective means to deliver information. There are many instances of such teaching, and in certain contexts at certain times this is entirely the most appropriate strategy to follow. No reasonable parent would allow their son or daughter to "experience" driving, to discover and explore their way to effective car handling skills! Similarly in the classroom, there are occasions where to ensure that the student grows, that progress is maintained and momentum achieved, that certain requisite skills be given to the student to allow them a base upon which to build. In a relatively small time frame, this form of teaching is an event, it is a prescriptive, deterministic, objectified event the success of which is evaluated according to specific criteria for the determination of the amount and type of information received.

Sometimes this is true and appropriate, but other times it most certainly is not. Intuitively, all teachers know the benefit of experience, of trial and error, of Personalized learning, of Doing. You cannot learn how to drive by being told about it or watching others. Teaching in this context now becomes one of facilitation and collaboration, of allowing the learner

freedom to roam and explore, to construct meanings as opposed to being given them. Teaching from this point of viewing is a process, subjective and indeterminate. It is a medium, a means or agency, a tool, an environment.

Thus the paradox of teaching. Just as with the paradoxes in nature, light for example, can one single entity be said to have two, mutually exclusive aspects describing that same entity? The response is Yes, it can. Complementarity holds that both aspects of an instance are necessary for a full and complete description. It depends on our point of viewing, for just as light can be seen to have both the attributes of a wave and a particle, so too, teaching can be seen to be both an exercise in management, and the facilitation of a medium.

Thus the point of this article: What is the nature of this whole that is teaching? Being made up, as it is, of two, seemingly mutually exclusive aspects, how can we describe the nature of teaching in such a way that it can be interpreted as a complementarity? First a description of the elements of such an environment, and then, using an example of a "teaching" situation using a computer-based, multimedia authoring application called HyperCard as the "message" from that medium, a discussion as to the meaning of the process.

The medium: Teaching

Teaching and learning are complements in the context of education. Erik De Corte (1990) bases his description of the elements of educational environments on the premise that "the new information technologies can only contribute substantially to the improvement of schooling if they are appropriately embedded in powerful learning environments" (p. 82). De Corte contends that such a medium is characterized by a good balance between discovery learning and personal exploration on the one hand, and systematic instruction and guidance on the other, always taking into account the individual differences in abilities, needs and motivation between students (p. 74).

De Corte describes six different methods which he argues facilitate the acquisition, integration and application of knowledge (p. 82).

a. **Modelling** involves the observation by the student of an expert who is performing a certain task; this allows the student to construct an appropriate mental model of the activities required for skilled performance.

b. **Coaching** refers to the observation of the student by the teacher during task execution as a basis for giving hints and feedback with a view to improving performance.

c. **Scaffolding** consists of providing direct support to the student while he is carrying out the task; this method derives from the Vygotskyian concept of the zone of proximal development.

In terms of the management/medium dichotomy

already described, it appears that the elements of modelling, coaching and scaffolding could be categorized as those aspects of a management approach to teaching. In all three instances, the teaching situation is directed by, and in the control of, the teacher. Modelling is the re-presentation of knowledge in such a form as can be accommodated and assimilated by the learner. Coaching is likewise an approach based on a "deficit" model, because through the hints and suggestions given, the learner is encouraged to bridge the gap between what the teacher wants or knows and where the learner is performing at that time. The concept of scaffolding as setting a target to be attained while in effect creating a "vacuum" which the learner is invited to fill, also represents the prescription, direction and management of the teaching/learning process.

d. ***Articulation*** refers to any technique that helps students to spell out and make explicit their knowledge and problem-solving procedures.

e. ***Reflection*** leads students to compare their own cognitive strategies and solution processes with those of other learners.

f. ***Exploration*** tends to increase the learner's autonomy in skilled problem solving processes as well as in discovering, identifying, and defining new problems.

These last three instances of teaching appear to me to be more "contextual" in nature, describing aspects of teaching which might be described by the medium approach to the nature of teaching. With all three, the emphasis is on the learner, "their knowledge, strategies and skills", and the role of the teacher is that of a facilitator, a collaborator, and indeed a learner as well. The tone and tenor of these last three aspects of teaching is far less objective and quantifiable, preferring instead to suggest that learning (and therefore teaching), is a process, a means, a Way.

Processes

Our cosmology, our world-view, our understanding of the Way of our universe, is undergoing a metamorphosis. As our understanding of the essential processes in nature grows and evolves, so too our understanding of the nature of the educational processes grows and evolves as well. Education is but one aspect of the larger reality of the unity of all things. Let us turn now to a discussion of these new, emerging paradigms in the sciences, and the teachings that they hold for us, as educators.

Evolving paradigms in chemistry and physics

The metaphor of the essential nature of matter has changed from a mechanistic view in which energy is conserved and transformed (Prigogine & Stengers, 1984) to one of "sparkling energy forever dancing with itself in the form of its particles as they twinkle in and out of existence, collide, transmute and disappear again" (Zukav, 1979, p. 213). Weaver (1985) in

describing the basic tenets of this new paradigm, contends that

> the mechanistic paradigm and the metaphor of the universe as a clock or a machine, has given way to a new paradigm which suggests that the universe is more like an organism, a process within which mechanism operates: there no longer is a clear separation between a subjective and an objective reality in which things are what they are regardless of whether or how we observe them; a human observer cannot observe or measure anything without affecting its very nature, and; finally, as opposed to the classical physics paradigm of separate, independently characterizable entities, quantum physics now speaks of transactions between entities, entities that are in some way defined through the act of relating to one another. (p. 312)

From a cosmology that was deterministic, externally imposed, a closed system of order beneath chaos (Zukav, 1979, p. 213), the work of Bohr (1912), Heisenberg (1971) and Prigogine and Stengers (1984) presents a cosmology of evolution, transformation, interaction, an open system of self-reorganization, of chaos below order from which dynamic structures emerge. Bohr's concept of the wave/particle duality of light, one in which the aspects observed are a function of the observer's perspective, in other words, that "what we experience is not an external reality but our interaction with it" (Zukav, 1979, p. 115), opened the doors for a re-examination of our assumptions and premises regarding the basic state and nature of nature. The objective, externally-defined reality of Newtonian physics in which certainty allowed for immutable laws of predictability, regularity and constancy, was being replaced by a paradigm of subjectivity, of interaction and transformation, of probability, or as Heisenberg describes it, "uncertainty".

> There are limits beyond which we cannot measure accurately, at the same time, the processes of nature. These limits are not imposed by the clumsy nature of our measuring devices or the extremely small size of the entities that we attempt to measure, but rather by the very way that nature presents itself to us. In other words, there exists an ambiguity barrier beyond which we can never pass without venturing into the realm of uncertainty. (Zukav, 1979, p. 132)

In this cauldron of chaos, "a continual dance of creation and annihilation, of mass changing to energy and energy changing to mass" (Zukav, 1979, p. 215), Prigogine & Stengers (1984) describe three states:

> (1) An **equilibrium** state exists when the forward and reverse actions of the molecules equal one another, and there is no further variation in the composition of the substance.
> (2) A **near-equilibrium** state is one in which interaction with the environment causes the reactions of the molecules to be linear and predictable. It moves as close to equilibrium as its boundary conditions in the environment will allow.
> (3) A **far-from-equilibrium** state in which forces in the environment cause the molecules to go beyond linear reactions to reactions in which spontaneous fluctuations occur. When

> this happens, the system becomes chaotic, and there can be evolution toward a new and qualitatively different organization. The system either moves forward to new order, or disintegrates and dies. (Allen, 1988, p. 8)

Thus from chaos may emerge order, an internally-determined structure transformed from within as an interaction from without. From such "open systems", Weaver (1985) contends that "Prigogine's theory of dissipative structures, whereby new, more complex, dynamic states of matter, structures, are transformed from disorder, represents a powerful model for understanding the nature and function of biological, social, or language systems" (p. 304).

Evolving paradigms in biology

The fundamental nature of the universe is activity, process (Weaver, 1985, p. 302). In such a medium, the only constant is a continual state of change, a recursive, reflexive, reciprocal process of growing and developing, new structures and entities emerging from the old, distinct, yet rooted in the medium from which they came. Extending the metaphor of the dancer and the dance being one from the sub-atomic to to the level of entities in a medium, Maturana and Varela (1987), have constructed the term autopoiesis to refer to the recursive, self-referential, self-maintaining process by which entities in an environment evolve and grow.

> An autopoietic system is organized (defined as a unity) as a network of processes of production, transformation and destruction of components that produces the components which; (i) through their interactions and transformations regenerate and realize the network of processes (relations) that produce them; and (2) constitute it as a concrete unity in the space in which they exist by specifying the topological domain of its realization as such a network. (p. 135)

Sawada and Pothier (1988), propose that autopoiesis can serve as a theoretical construct to describe the nature of educational environments. The Tree of Knowledge (Maturana and Varela, 1987), therefore, in representing the recursive, reciprocal, reflexive interaction of an organization in its environment, becomes a metaphor, or icon, both for nature, and education.

Recursion, as the "mechanism" from which emerges the state of autopoiesis, is defined as a process which operates on the product of its own operation (Maturana and Varela, 1987, p. 253), a self-referential, levelled process. Recursion connotes a hierarchical, highly embedded organization in which any given process can be embedded within any other (Flower and Hayes, 1981, p. 366).

> Within the narrative of life itself, all plants and animals show a time structure, of which the rings of growth in trees are an elementary example, and the cycles of life history a more complex one, for every plant and animal is constructed upon the premise of its cyclic nature. (Bateson, 1972, p. 344)

Reflexivity, as an introspective, self-referential process, maintains the unity of the system throughout recursive interaction. The natural circularity of the system maintains the order of the system, and in turn the circularity or recursion is maintained by the system (Allen, 1988, p. 12). In educational terms, to be reflexive means that learners are able to take a step away and then look back on what they have done, on what they are doing and on where their learning might lead. A reflexive stance empowers learners to look around; they focus not only on the topic at hand, but also on the periphery and beyond - on the spin-offs, the connections made and not made (Harste, 1989, p. 14).

The mechanism by which the inherent paradox of self-referentiality is disrupted, is "structural coupling" (Maturana & Varela, 1987, p. 75). Zukav (1979) alludes to this concept of structural coupling in the physical domain when he writes that "the physical world is not a structure built out of independently existing unanalyzable entities, but rather a web of relationships between elements whose meanings arise *wholly* [my emphasis] from their relationships to the whole" (p. 96). We are thus at a systemic point of viewing, one which is holistic and connected, a web of meaning.

A plastic, structure determined system (i.e. one whose structure can change over time while its identity remains) that is autopoietic will by necessity evolve in such a way that its activities are properly coupled to its medium (Winograd, 1986, p. 45). Thus we have a medium in which entities evolve as structurally determined systems in a recursive fashion, yet in a constant state of adaptation to experiences in that medium both internal and external in origin. Such is the nature of all environments.

medium/messages

The messages from the medium are those instances of authoring in the situational context (Harste et al., 1984). In the context of teaching and technology, the messages are the compositions authored by the students in HyperCard. I would like to present to you one such example, an interactive multimedia production based on a novel, and the narrative of the process as described by the author.

Never Cry Wolf

By Erin Kemp

We had an assignment to do in our grade seven class on the novel Never Cry Wolf. Our assignment was to design a game on the novel. At first I was going to do a board game but my Dad came up with the idea of doing a choose your own adventure on computer.

So we sat down and we decided that the pups should get lost and your job could be to chose where to go and to go through the steps to find the pups and bring them back to the wolf den.

We started out with only having two choices but we decided that it would it would be more fun if we had four. And after some thinking we decided that North, South, East and West

would be perfect (Dad came up with that idea). Then he started writing down what my ideas were (Dad had many suggestions too that we included also and were important). It only took us about five or ten minutes before we were finished. This is our outline that we made:

We came up with these ideas: You can see poachers hurting a pup, You can find a ransom note saying that the robber has three pups and that he want's five hundred dollars for them, You could fall into a stream and drown, or you could meet a bear. There are many possibilities.

When you go West the first thing on the screen is some writing about the poachers hurting a pup. Then it gives you two choices, you can go get help or you can run. If you go get help you get chased by the poachers (which would personally scare me to death) and the pups get set free. Then you get cornered and you have two choices to make, you can take the short-cut through the stream or you can take the long way on land. If you take the short-cut through the stream you trip, get a concussion and you drown. But if you take the long way (you have a better chance of living but it is in fact the long way) on land you run faster than the poacher and you escape, find the pups and you return them to their den. But if you run when you see the poachers hurting the pup you trip and fall and you land on another pup. You figure out that the pup has a broken leg and it can't walk back to the den so you make a splint out of branches and some string you had and you carry the pup back to the den.

If you go North you find a ransom note saying that the robber has three pups and he wants five hundred dollars by tomorrow, you can meet him by the stream at three o'clock and that's where you'll make the switch. Then you get another decision, you can ignore the note or you can try to get the money and pay him. If you ignore the note (which I would probably not do), you ignore the note and then as you are walking back to your tent you hear squealing, a high pitched squeal like one of a wolf pup. Then you get two more choices you can go look for the pup and the robber or you can ignore the squealing. If you decide to go look for the pup you find the pup and you beat up the robber and you return the pup to the den. (you get more than enough gratitude). If you choose to ignore the squealing (poor pups) you go to your tent and you are just sitting there when you hear squealing and you change you mind and you decide to go and look for the pups. You look and you look and you never find the pups and it's game over. But if you try to get the money to pay the ransom note you look for some money you had stashed in your tent and you can't find it, it's gone!!! So you get two choices, you can choose to find the money (which most people will do) or you can choose to not find the money. If you choose to find the money you can take the money to the stream and leave it there without the pups. And you never get the pups. If you choose to not find the money you show up at the stream without the money and the robber feels guilty and he gives you the pups for free.

Then if you go South you fall in the stream and you drown and that's the end of your game.

If you choose to go East you meet a bear (which would make me have a heart attack I would be so scared) and you get two choices, you can run for your life or you can fight the bear. If you choose to run the bear catches you and you die. If you choose to fight the bear you survive but you are hospitalized for life and you are badly injured.

The next thing that we did is Dad took me upstairs and he taught me how to use HyperCard, and that's when a whole new world of possibilities opened. The first thing that we did was Dad taught me how to get new cards. Once I had accomplished that, Dad taught me how to get a new field, which is the box that you write in. Once that was done I learned how to change fonts. Then once I had made a few cards Dad came upstairs and he taught me how to connect the cards by using buttons. Once I had learned how to do that, I started to make some more cards and connect them all together. Then I finished all of my cards and I connected them all and I was done.

The thing that I liked most about using HyperCard was all of the possibilities that it has, you can do just about anything with it. It has a world of new possibilities for you, they are all there for you almost like they're there waiting for you to use them. If I had to do it again I think I would do my story on horses or on bears because they interest me so much. I am not sure if I would do a choose you own adventure but then again, what other type of game would you make, there are only so many types?

Now that I have told you my game plan I have to tell you it definitely was a new experience for me using HyperCard but now I know how to use it and I enjoy using it now. I plan on adding sound affects which I haven't already made and possibly animation. For example when you fall in the stream and you drown I could make bubbling sounds like from a tub draining or from an aquarium. And for animation the part where you meet a bear, I could find a picture of a bear in the HyperCard Graphics and make growling noises and show the bear coming towards you. So I am very pleased with this and I am very glad that my Dad came up with the idea of doing my game on computer because it was not only fun but it was educational and it was challenging and I really enjoyed doing it as well as working on it.

What Dad did was he basically to sum it up is, he taught me HyperCard and he helped me with my game, planned it out and he wrote my game plan out for me which was a big help because it would have taken soooo much longer if I would have done it.

Never Cry Wolf

by Stephen Kemp

Erin first approached me to help her design and develop a board game which had been given as one choice for a novel study assignment. We actually planned out a rough draft of a "trivial pursuit" type game where the objective was to retrieve the lost Wolf pups and return them safely to the den. I don't know why, exactly, but I offered to teach Erin how to do an interactive story using HyperCard. Erin had some experience with HyperStudio for the Apple IIgs, so she was familiar with the concept of interactive multimedia.

We started out by designing our story in rough form. Notice how I said, our, because it was very much a collaborative effort. I offered to write down the outline so that Erin could

concentrate on the ideas. It was my idea to have the possibility of going in any one of the four directions to look for the pups. Erin quickly began to spurt out ideas as to what could happen, but I guided her to working on one branch until its conclusion, and then going back up to fill in the other possibilities. We completed the West - Help - River branch, and then finished off the Long run on land branch. We then went back up to the Run branch, and finished that off together. Basically, I would ask questions such as, "Okay, then what?", or "Why?". I showed Erin the basic format for the outline, the use of the branches and the options in the lines leading out from the boxes, which contained the main ideas.

I then decided to leave her on her own, and she began the North - Ignore - Look branch. She worked on her own for a couple of minutes, and then I noticed that she had branched off a choice instead of a main idea. I stopped her, and we corrected the outline so that the choices went to other main ideas. I took over the job again of scribing the outline, and we finished the North option. Erin supplied all of the ideas, and I just wrote them down.

We started to think about the other options, but decided that perhaps we should make them short ones because the story was already getting quite detailed. Erin thought of the consequences of going South and East, and we finished of those branches in outline form.

We went upstairs to work on the computer, and I showed Erin how to create a new stack, and how to create a field and change the type styles and fonts. I suggested pulling off the Tools menu, and she kept it on the screen all of the time. I showed Erin the concept of the background and foreground, and imported a digitized graphic of the forest for the background, a graphic Erin had seen on the cover of the last issue of my journal. She thought that it would make a perfect backdrop for a story set in the forest. After doing that, I decided that perhaps just doing the fields was god enough, so after I demonstrated how to create a field, add text, edit the text and create a new card, I left her on her own. She finished the entire West option of cards, and then came and asked for my help.

I showed Erin how to create a new button, add effects, and then link them using the arrow keys. I did just one as an example, and then I left her to it. The next time I checked in on her, perhaps a half hour later, she had connected all of the cards, and was well on her way to finishing the North branch. She finished off the stack at one sitting, and then proceeded to play it for herself to make sure all of the branches worked. She edited as she went through, making spelling corrections and fixing up basic sentence structure and grammatical mistakes, but there were very few of any of those.

Once completed, I suggested that sound would make an excellent addition to the stack, so we agreed that I would try and borrow MacRecorder from a friend of mine and she would add some sounds. That's the progress up to this point, but she seems very, very interested in continuing and finishing her stack so that she can take it to school and let the other students "play" it on their MacJanet network at school. Erin seemed to take great pride

in what she had learned and done, and I was very proud of being able to give her another option to do her school work.

Within this narrative are the elements as described by Erik De Corte. There were times when I did model and coach and scaffold, but there were other instances where I allowed Erin to articulate and explore and reflect back on what, and how, and perhaps more importantly, why she did what she did. Was a balance achieved? I do not know, for there were no records kept, no checklists maintained. But in the enthusiasm of Erin's narrative, and the fact that she sat at the computer for well over 2 hours without interruption can perhaps a clue be found. If this was not an instance of a learner and a teacher being structurally coupled, or an instance of one medium (Erin) being structurally coupled with others (myself and the technology), then the autopoiesis would have not been maintained, and the system would have disintegrated. As it was, the exact opposite was true, and Erin now looks for other opportunities to express what she knows in this medium.

medium/messages/meaning: A paradigm of the nature of the teaching process

The meaning of the messages from the medium of a teaching/learning experience is our own personal construct. For myself in this situation, the attributes and qualities of the experience were those of a dynamic, open, evolutionary environment. It was a process of growth and attachment, of Personalization, of developing Voice and Self. It was recursive, reflexive and reciprocal. It was most certainly systemic. It was empowering and engaging, and it was fun!

A paradigm of teaching environments

Emerging paradigms in science (Prigogine & Stengers, 1984; Maturana and Varela, 1987) have proved to be the catalyst for a parallel paradigm shift in education (Weaver, 1985). As a synthesis of the work of De Corte, with the lessons from the emerging paradigms in science and education, I would like to propose an autopoietic paradigm. It is my contention that such a paradigm represents both implicitly and explicitly the recursivity, reciprocity and reflexivity which are fundamental processes encompassing all of the elements in any environment.

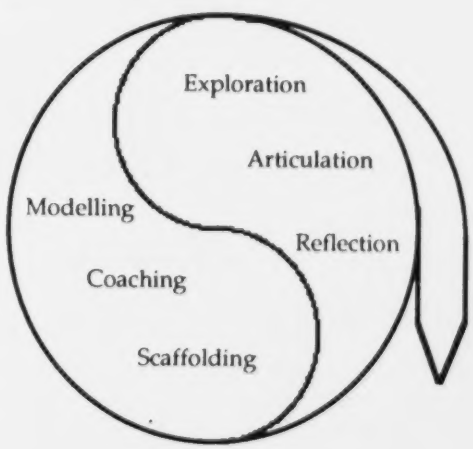


Figure 1: A paradigm of teaching environments

The Taoist "yin-yang" circular configuration was chosen to symbolize the holism, connectivity, balance and unity of all aspects of a medium. Within the paradigm, the elements of an effective teaching/learning environment as outlined by De Corte (1990) are incorporated. The curved line represents the balance between the two aspects of "management" and "medium", explicitly describing the nature of the relationships between the elements. The openness of the medium, so that the creative growth, or autopoiesis, can be maintained, is represented by the "pencil-like" icon which flows out of the paradigm. However, the nature of the pencil is more like that of a stylus, one in which the transmission is reciprocal: there is both the recording and the reception of information.

This paradigm, then, represents the nature of the medium that is teaching. It is an open, dynamic system, articulating it's messages out and beyond. If this environment is to evolve and grow, it must remain structurally coupled with all other instances of teachers and learners. Thus the stylus, for there must be a reciprocity of action, inter- as well as intra.

Summary

The nature of the educational medium is changing. New paradigms in science are finding their parallel in education. Our cosmology, our world view as to the nature of all processes in nature, is changing from that of a systematic, mechanistic, deterministic paradigm, to that of a "web", a systemic paradigm which speaks of holism, connectivity and balance.

Erik De Corte has described 6 elements in an educational environment, elements that appear to emphasize both the management approach to teaching, and a "medium" approach. The question now becomes one of the relationships between the elements. Employing the metaphor of the web, a balanced complementarity, a paradigm was developed which seeks to describe the nature of the relationships between those elements. It is not a question of right or wrong, better or worse, but 2 aspects both of which are necessary for a full and complete description.

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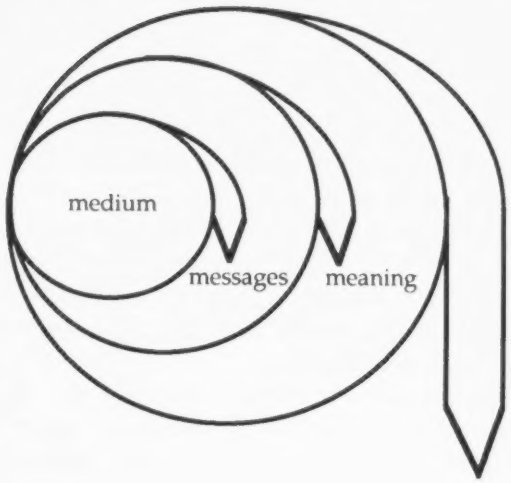
Understanding the process of multimedia authoring

Abstract: This article describes the elements, processes and relationships in the context of computer-based, multimedia authoring environments. A paradigm will be developed which will look at the medium of multimedia authoring, the messages which emanate from that medium, and the meaning of those messages. Specific examples of each will be presented from the compositions of the students of Bishop Pocock School in Saskatoon, Saskatchewan.



Recent advances in technology, coupled with a re-viewing of the nature of the educational process and the role that technology might play, are affording educators and learners new, exciting opportunities for exploration, discovery and articulation. While the literature of 5 years ago spoke of the next generation of computers as being "Artificially Intelligent", the difficulties in trying to simulate or replicate the human system, coupled with the advent of computer-based, multimedia authoring environments now promises to re-present the computer as an important, integral aspect in the total context of a new, emerging, educational paradigm. The medium is changing. Education is a dynamic, evolutionary, emergent process, and that process now includes interactive multimedia. The question, or opportunity which emerges, is to describe the nature of this new opportunity for teaching and learning and researching. What does it mean to author in this new context?

This paper will describe one such journey into this uncharted realm. It was a journey for which there were no signposts, no directions, no map of the lay of the land. It was a journey fraught with confusion and uncertainty, but motivated and sustained by excitement and opportunity. This journey is told from the point of viewing of the students, not from my perspective, although I was as much a learner as a teacher in that regard. But I want the comments and compositions of the students to tell the story, an unfolding narrative of the process of coming to understand the nature of interactive multimedia.

medium

The medium is computer-based, multimedia authoring. Multimedia is an extension of the term "text" to include other components such as video, illustrations, diagrams, voice and animation, and computer graphics (Horn, 1990, p. 12). In the medium of PowerPoint, an on-screen, slide show

presentation application, the limited graphics made it necessary for the students to use another painting application such as MacPaint to generate graphics which were then "Pasted" into their compositions. Some commercially prepared Clip art images were available, but the choice was relatively limited.

In the medium of HyperCard 2.0, a commercially produced authoring environment from Apple Computer Inc., graphics may be created from within the program itself by the means of various painting tools very similar to those available in other art programs such as MacPaint, MacDraw and SuperPaint. In addition, graphics may also be incorporated from collections of commercially prepared graphics known as Clip Art, and then edited using the graphics capabilities of HyperCard. Sound is available through a number of different applications such as HyperMacintalk, which emulates human speech through a phonetically-based approach, or MacRecorder, which digitizes sound and provides for sound creation and editing functions. These sounds can then be incorporated directly into the HyperCard compositions. Animation is possible within PowerPoint by rapidly presenting each frame with a delay of one second, and in HyperCard by creating a series of nodes which differ slightly in the presentation of the graphics, thus replicating the crude animation created by rapidly flipping through a series of cards. Other forms of information transfer include the integration of productions from other applications programs running under the "umbrella" of HyperCard, and the incorporation of video and scanned images.

Jerome Harste, Kathy Short and Carolyn Burke (1988), in their work entitled Creating Classrooms for Authors: The Reading-Writing Connection, have proposed the authoring cycle as describing the process of authoring in a paper medium.

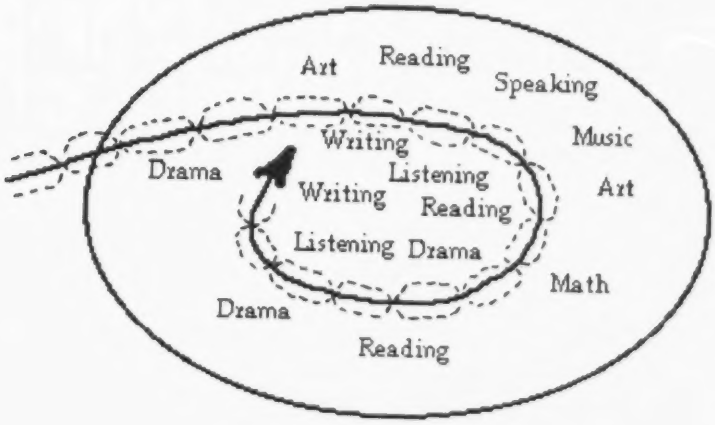


Figure 1(a): medium: The authoring cycle (Harste, Short, & Burke, 1988, p. 10)

> Learners bring to the cycle a stock of life experiences that are the basis for engaging in personally meaningful communicative events. The oval that surrounds the cycle represents the situational context **[the medium]** in which all instances of authoring are embedded, and the activities listed outside the oval represent the multitude of culture-specific contexts in which literacy events can be enacted.
>
> The path of the cycle crisscrosses between the alternate communication systems of language, art, drama, music and math. This is a recognition that both authoring and learning are multimodal processes and that authors shift stances from reader to writer to artist to speaker and so on.
>
> As authors move between communication systems they are able to expand the range of meanings they can express. A final aspect of the cycle depicted in this diagram is the regenerative nature of authoring. Neither authoring nor learning is seen as having an end point. When meanings are expressed or created, they metaphorically become fuel for the next cycle. (Harste, Short, & Burke, 1988, p. 10)

Based upon the paradigm as described above, I would like to propose the following model as representative of the authoring cycle in a computer-based, authoring environment:

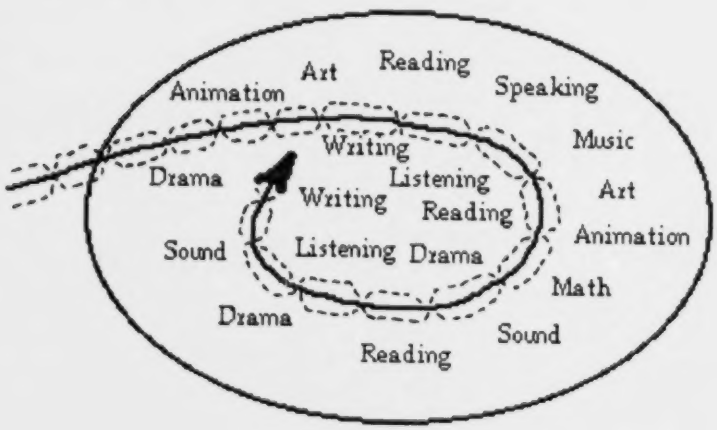


Figure 1(b): medium: A computer-based, multimedia interpretation

Note that the multi-modality referred to by Harste, Short and Burke has changed to reflect the nature of the medium. To those modalities already listed can now be added those specific to the new medium: sound and animation. In this respect, technology has but complemented the variety of life experiences which the students brought to the composing task, an amplification and elaboration rather than a muting and constricting.

medium/messages

The medium is the situational context (Harste, 1984) in which all instances of authoring occur. The messages which emanate from that medium are those "products" or compositions which emerge from that multimedia environment. Again, in the paradigm of Harste et al, Figure 2 represents those messages which were produced by this new context of interactive multimedia:

The oval represents the situational context, or medium, that was both PowerPoint and HyperCard. The activities listed outside the oval represent the variety of uses which these computer-based, multimedia applications were employed by the Grade 8 students at Bishop Pocock Elementary School. Following are examples of the work of the students in those media, and transcribed descriptions of the processes they followed in the design and development of those compositions:

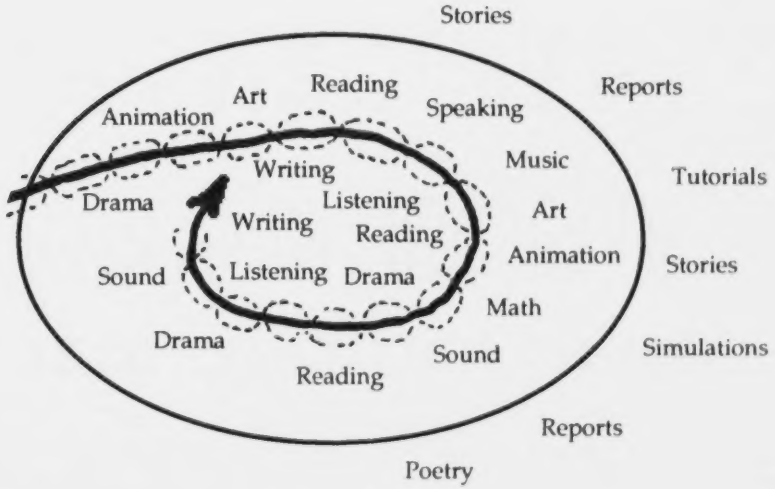
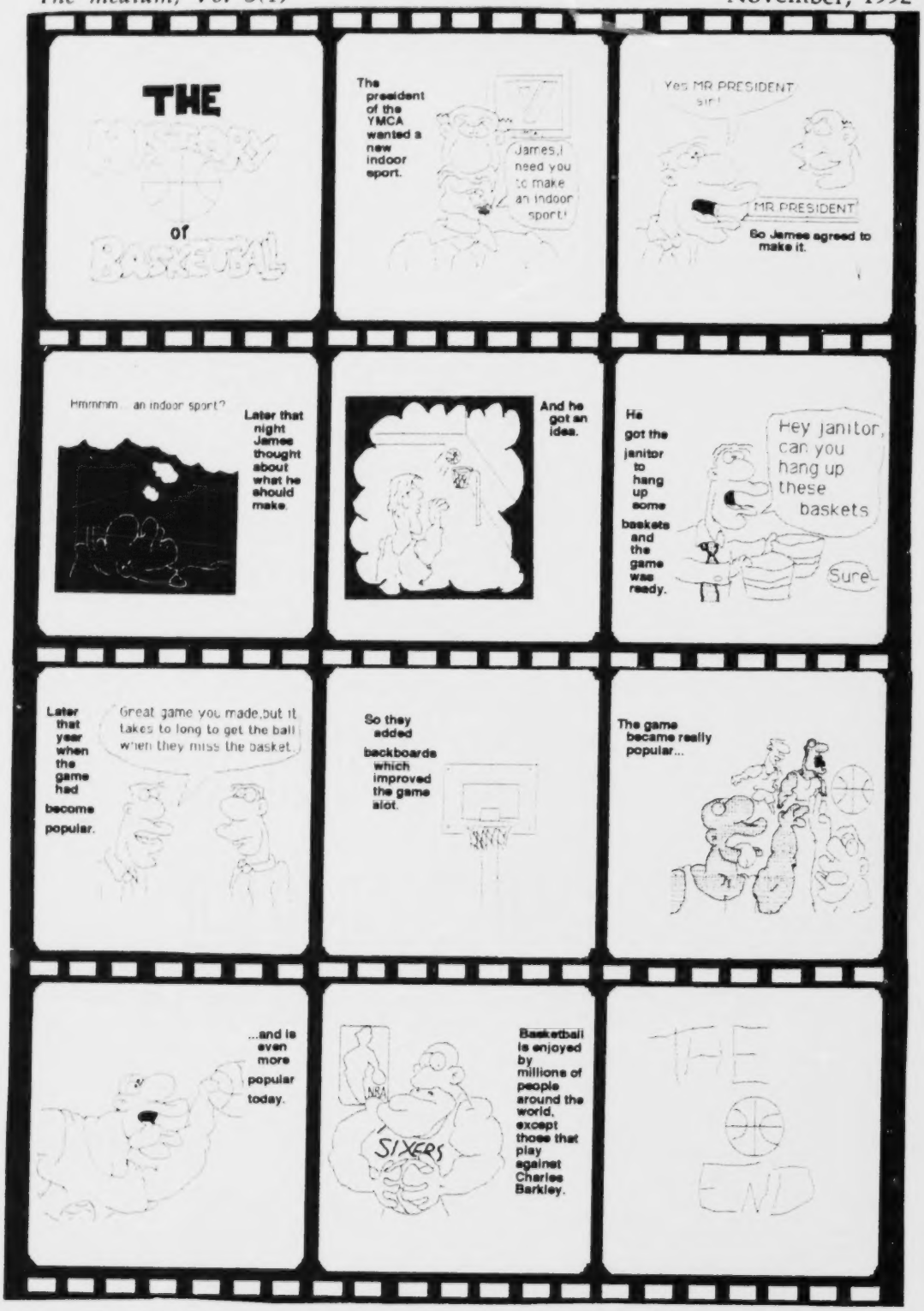


Figure 2: medium/messages


THE
of
BASKETBALL
The president of the YMCA wanted a new indoor sport.
James,I need you to make an indoor sport!
Yes MR PRESIDENT sir!
MR PRESIDENT
So Jamee agreed to make it.
Hmmmm... an indoor sport?
Later that night Jamee thought about what he should make.
And he got an idea.
He got the janitor to hang up some baskets and the game was ready.
Hey janitor, can you hang up these baskets
Sure
Later that year when the game had become popular.
Great game you made,but it takes to long to get the ball when they miss the basket.
So they added backboards which improved the game alot.
The game became really popular...
...and is even more popular today.
Basketball is enjoyed by millions of people around the world, except those that play against Charles Barkley.
SIXERS
THE
END

My slideshow or the idea for my slideshow first came from two facts straight out of our school encyclopedia. Using the facts from the encyclopedia I decided to make a story instead of just a report. I couldn't figure out how to make a story long enough by just using total facts. The encyclopedia gave me most of the facts and the basic storyline, like how the President of the Y.M.C.A. told the inventor of the game to make a sport for winter and how

the game later adopted backboards. I still had to make some things up, for example, I had to make up how the inventor of basketball got the idea for the sport through a dream, and how a friend of the inventor pointed out how the game would be better with a backboard for when people missed the rim. After I had put the actual information and the made-up information together to make a good story that made some sense, I was able to start working on the computer.

I started working in MacPaint because I felt PowerPoint's tools were too limited. I drew about five pictures in MacPaint. These pictures included the actual graphics as well as any speech that was inside the picture, such as words in speech bubbles. Then I would transfer these pictures to PowerPoint. In PowerPoint I wrote the words on the side that told the story. Before I had done any of this work in PowerPoint and MacPaint ! had a pretty good idea of what I wanted to draw and what I would write, but I didn't need to use storyboards because I was able to fill in little details as I was working. After I did my work in PowerPoint I went back to MacPaint and went through the same process. The only reason I used this process was because after I had drawn a picture I always thought of the perfect thing to write after I had drawn the picture. So, if I drew too many pictures in a row I would forget what to write. After I had finished all my slides, I had nothing to do because my slides were in the right order and I felt they were as good as I could do. I made it into a slideshow, I was happy with it the first time, and then I was done.

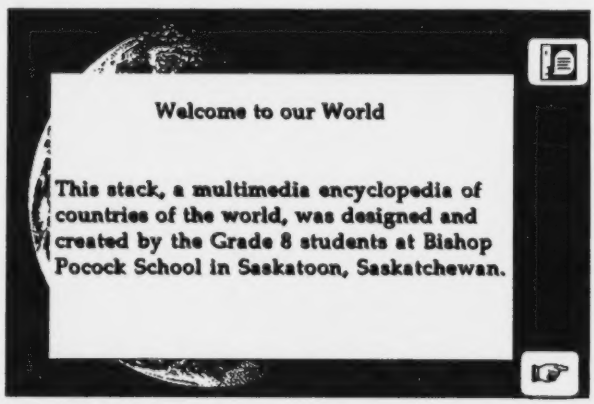
In this instance, the students relied on their own artistic abilities to draw all of the graphics in the art program, MacPaint, and then incorporate them into their slide productions. The ideas, the way of communicating their understanding of Basketball is entirely unique to the students. My role? Well, after the initial 1 hour introductory lesson, basically, I was transparent most of the time! There were occasions when I was asked for advice, once I was even asked for my opinion (!), but the students were self motivated, self-reliant, and self-sustaining. The synergy created in that lab setting was unbelievable. The peer group barriers were non-existent. Girls worked with the boys as collaborators, not as adversaries. There was genuine cooperation and a growing sense of mutual respect and appreciation for the work, ideas and talents of others. Forget the notion of learning disabilities. Some of the most creative, most expressive work was produced by students who are "labelled". Yes, they needed help with spelling and punctuation and grammar, but the effort, the application, the pride was unbelievable. But the best was yet to come. PowerPoint was an intermediary step to the next level in their evolution as computer authors, that next step being HyperCard.

HyperCard is a true multimedia authoring environment in the sense that not only can you combine text, graphics and animation, but with the addition of a relatively inexpensive software package called MacRecorder, the students could now add sound. I chose a research project that meshed nicely with our work in "Social Studies", that being the design of a multimedia unit on countries of the world. Originally, I had intended to work towards a Folkfest, where the students would create centers that featured a certain country of their choosing. Instead, we focused our attention to designing a multimedia encyclopedia using HyperCard. HyperCard has one extraordinary feature that separates it from the linear, sequential presentation format of PowerPoint. In HyperCard, you create "cards" of information (usually

one screen of information equals one card) which can then be "linked" together using "buttons". The idea, then, is to be able to create a knowledge base where a user could sit at the computer and take any number of different paths in and through the knowledge. For example, the user asking for information on Mammals might lead to information on whales, which might in turn lead to the Blue Whale, which might lead to migratory patterns and so on and so on. The task for the author of the knowledge base, however, is to connect, or link the information in such a way that it permits the user a wide range of flexibility, but also has within it a sense of continuity. Also, the task was to synthesize and represent the information in such a way that it was coherent, informative, correct, and complete to the extent that was possible on one "card" (or screen of information). Oh yes, it had to be entertaining! The students generated the categories of information they wanted to research and began the collection, synthesis and presentation of the material. The unique features of HyperCard allowed the students, again, a tremendous opportunity to express what they knew in a way that was personal and unique to them.

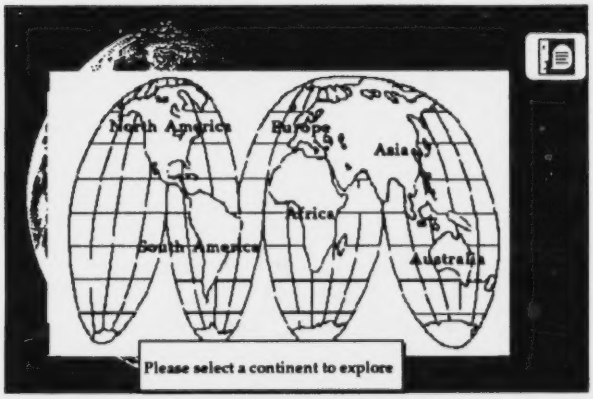
My role again? I did not spend 2 hours of direct instructional time. The experiences gleaned from MacPaint and PowerPoint were put to good advantage by the students, who more and more were turning to me for advice, comments, and suggestions, but not for help or guidance. My role was truly that of a facilitator, not a manager, but a collaborator in the entire process. I was, as were all of the students, both a teacher and a learner.

This is our title card. We wanted to think of a neat graphic that could describe what our class project was all about. Tyler thought that a picture of the world would be perfect, but we couldn't draw good enough, so we went to the library to find a picture in an atlas or an encyclopedia. We found this picture in a HyperScan sample. Then with Mr. Kemp's help we edited the image to make it look as good as possible. We then copied the image into HyperCard. It was Lloyd's idea to put the world in the background so it would appear on every card of the introduction. We filled in the background so that the rest of the screen was black, and then added the text in the foreground. We created the button, and chose an icon instead of a message because we thought that it looked more professional like that. When the rest of the class saw the title card they thought it was great.

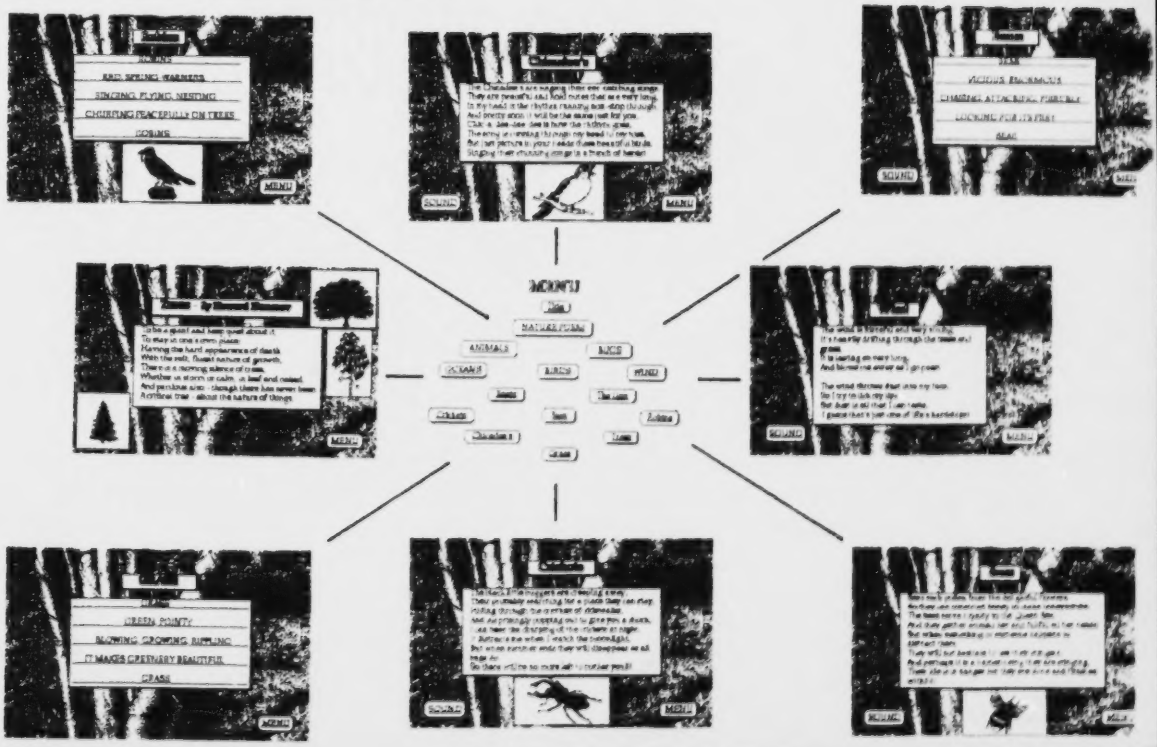

Welcome to our World
This stack, a multimedia encyclopedia of countries of the world, was designed and created by the Grade 8 students at Bishop Pocock School in Saskatoon, Saskatchewan.

Our group made the world map card (below) which showed all of the continents. Our class had decided that these were the general areas in the world that we would choose a country from. We had to decide what type of map we wanted to use because we had several different types. We found this map in our Clip Art collection, and we thought it was perfect because it showed the whole world and there was enough room to print all of the different continent names in shadow style printing. We copied the map into the scrapbook and pasted it into HyperCard. We created a white box and placed it in behind the map so you could see it clearly. There was a lot of discussion in our group about how to label the

map, or show the buttons. At first we were going to fill the continents with different patterns, but we didn't like the way it looked too messy. Then we were going to put a menu of choices on the side, but then John came up with the idea for transparent buttons over top of the continents. We liked the idea of pointing at the continent you wanted and then something would happen. We created transparent buttons, and used the button names for the continent names. We then placed all of the buttons and made the final adjustments of size. We changed the font so that it had a shadow effect just like the first group had used for the credits. We created a text field for directions in case the person using the stack did not realize that they could click on a continent. We didn't do the effects or links because we had to wait for the other groups. (Amy, Chantel, Derek)



The final level in the evolution of the multimedia authoring process was the design and development of HyperCard stacks on topics entirely of the student's own choosing. The interactivity of the HyperCard now permitted "Choose Your Own Adventure" type compositions, relational databases, simulations and games. The incorporation of sound and animation was an important aspect of the compositions at this level, and as the nature of the medium changed, so too did the nature of the authoring process, and the nature of the means of expression which the students employed.



Nature Poetry

by Abigail Dy

My HyperCard project is on nature poetry. On each card I have a poem and some of the cards have some pictures on them. I have a background picture of a forest which came from HyperScan. The types of poems that I wrote are rhyming ones, ones without rhymes, Haiku, and cinquains.

First of all I made an outline as to how I was going to do it, and arranged my project in my journal. I looked for poems about nature in the library, but decided that I liked writing poetry too and so maybe I should write the poems instead of using someone else's. I made up one poem just to see if I could do a good job, and decided that my poems were just as good as the others because they were mine. My first poem was the nature poem, and it had in it all of the things that I wanted to write poems about. I thought that the other poems could be about things mentioned in the nature poem, and this was really good because then the whole stack was kind of complete and it made sense because it was all connected. After I finished my nature poem I started to write other poems, but I ran out of good ideas so I went back to the books I looked at before and used some of those poems because they were pretty good and they fit into my stack.

Then I started to work on the computer. I first designed my nature poem card. I found the neat background of the forest in HyperScan, so I decided to use that for my stack. I used fields for each of the poems so that you could see them. I typed in my nature poem, and decided to make the words that were poems in bold so you could choose to read those poems if you wanted too. Mostly I was just copying my poems from my journal into my stack, but once I was working away and I thought of a poem while I was working so I created a new card and quickly wrote the poem out. That poem sounded really good so I decided not to write any more poems out before I typed them into the computer. From then on I typed out my poems in the lab with help from Chan and Amy and Melissa. It was really neat and I really liked making the poems and then linking them together. One day I heard Norbert's stack that had music in it and I decided that I wanted to add sound, so I used MacRecorder and I recorded a whole bunch of neat nature sounds off a cassette that I borrowed from the downtown library. It was a lot of fun recording the sounds and then pasting them into my stack. I thought that I might record me saying the poems but then I ran out of time so I didn't get to do it. I think adding sound to my stack made it really special because it made it come alive. I also added Clip Art when I could find pictures that matched the poems. The last thing I did was make my menu card. I tried a whole bunch of designs but then I tried the diamond shape and I really liked it. I made the menu because after other people looked at my stack they suggested that maybe it would be a good idea to let people choose what poem they wanted without reading the nature poem. I thought that was a good idea so I made a menu card. I was really happy with my stack, and really proud because no one else thought of doing poetry and everyone thought that was really cool.

medium/messages/meaning

The meaning of the messages from the medium of interactive multimedia is left to the students themselves. In other issues of *The medium* , I have tried to describe the attributes or qualities of the process that I was both an observer of, and a participant in. Now I turn that task over to the students. I once again used a concept mapping approach in which I asked the students to generate a list of elements for the topic at hand: Our year in using the computer was like a ..... The only proviso was that their interpretation be iconic, that the symbolism they chose to express their understanding of the process be explicit in the construction of that symbol. To continue to add "the growth rings of meaning to our understanding", I would like to present the following paradigm

which I would like to offer as a paradigm, a model, an icon for our journey together into multimedia authoring environments:

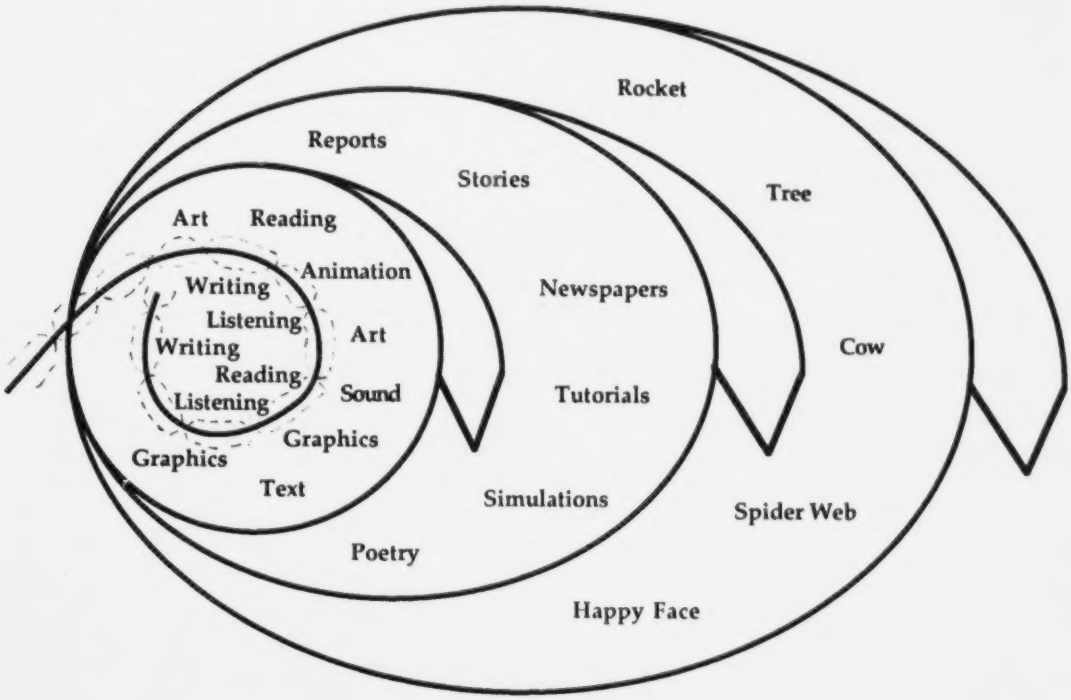
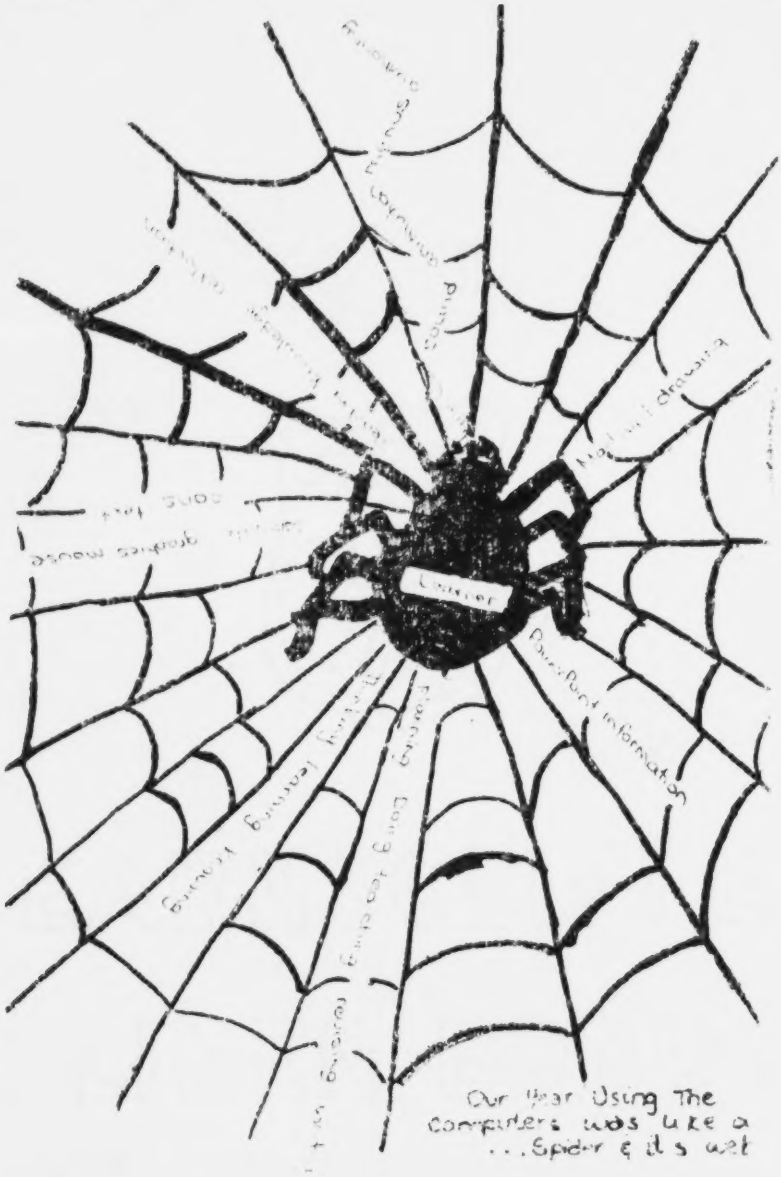


Figure 3: medium/message/meaning

The meaning of the journey which my students and I shared during my year at Bishop Pocock School has been described in my terms, my words, from my point of viewing. In describing our year, and in trying to come to some understanding of it's meaning, I have used terms like recursive, reflexive, reciprocal, emergent, evolutionary, multivariate, and so on. But I turn the task over now to the students themselves, for the medium of expression was ***theirs***, the messages which I have shared with you were ***theirs***, and now, I would like to share with you ***their*** meanings of those messages from the medium.

Our year of using the computers was like a .....spider spinning a web.....

The medium: Okay, you've drawn a spider spinning a spider web. What does it mean?



Abigail: Well, the spider is us, the learners, and we're making a spider web that is everything that we've done and learned.

The medium: You're making the web, this is the learner making something which joins together everything that you've been working on?

Chantel: And as we learn more and more things, then the web gets bigger. We didn't know how the spider spins his web, you know, do they start off with one strand and then string the others or what, but we thought that what was important was how it looked, you know, with all these things connected together.

The medium: How did you think of that? Who came up with the idea?

Claudia: I did, and then we all sort of agreed. I don't know how I got the idea, maybe just because I was thinking of a way to join all these things together and to show that it got bigger and better, and then I just thought of a spider web and I said it.

The medium: So you were looking for something that could show how all of these aspects here were connected, and then how once you joined them that it got bigger and began to grow, is that right? (General agreement from the group) Now you've got groups of information here, you've got MacPaint and drawing, you've got PowerPoint and information, you've got computer, graphics, mouse and so on, what's the reason behind grouping them in that way?

Chantel: That's what we did when we used those programs.

The medium: I see, and HyperCard and sound, menus, animation and authoring was all part of HyperCard. What are you saying about teacher, knowledge and reflection?

Chantel: You, the teacher, had some knowledge about the computers and once you gave us that knowledge then we started spinning the web (laughing!).

The medium: What about reflection? Did I encourage you to reflect back on what you had done?

Claudia: Whenever we wrote in our journals then we would think back, we would replay the thing over, and that's reflecting, right?

The medium: Tell me about planning, doing and so on.

Abigail: These are the things that we would have done, mostly on our own, but sometimes with our groups, and sometimes you.

The medium: I like the way these, these strands that connect the web together, the main strands, I love the way they bring everything together.

Melissa: That's to show that all of these are connected. We wanted to show that you couldn't just do one thing alone, that we sort of joined all these together.

The medium: Is the inside word important, for example, I notice you've got MacPaint in the middle and drawing coming out of MacPaint. Did you do that on purpose?

Claudia: Yes.

The medium: So what about planning, doing, teaching, and so on, are they in order?

Melissa: Kinda, they were in the order that we thought most times we would do them, but sometimes that didn't happen, but most times this is the way it was. The order was thinking, then learning then knowing. But some of these words just don't belong here.

Claudia: Yeah, like menus belongs everywhere, and so does information, and text.

The medium: What about reflection?

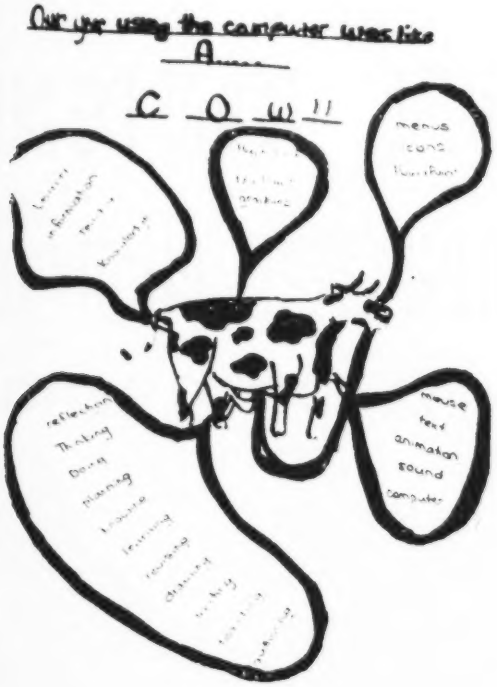
Chantel: That's in all of them too, because you're always going back to them or thinking about them, like sometimes after I drew a picture I had a new idea, and sometimes more information, and then I would change what I was going to do. Sometimes, like after PowerPoint, when we thought back on what we did, and stuff, I used a lot of that in HyperCard and it really helped, because I'd never kind of kept on using what we had already taken, like most times we would do something and then just leave it and not worry about it anymore, but this year we always kept thinking back and kept using what we already had done to make the new stuff easier.

Abigail: ...and better, like everything I did got better because I kept on using what I already knew, so it made it easier.

The medium: What about you as a learner, is this something different?

Chantel: Yeah, because I improved on my mistakes. But it's the same in other stuff too, like in Math we always keep going back, and the same in social and science, right?

The medium: Well, I like to think that everything is connected, and that's why I enjoyed your spider web so much, because everything was connected. Anything else, ladies? No? Thanks, that was terrific, I really enjoyed our discussion.



Our year of using the computers was like a .....cow.....

The medium: Why was using the computer like a cow?

Carrie: Because a cow has 5 stomachs, and then there are 5 different things that were happening while we were using the computer.

Amy: These are all the doing words, like reflection, doing and stuff, they're the doing things, and these (menus, icons, etc.) are in the computer, but this?

Stephanie: This doesn't belong (PowerPoint) here with these.

Amy: Oh yeah, we glued it in the wrong one, we should have moved it into HyperCard.

Kate: And graphics but these could be switched around too, like they don't just belong in these groups, like they belong with others too, that's what PowerPoint is in here, but it could also be with HyperCard.

Stephanie: Yeah, we'd switch graphics and PowerPoint, but they could stay too.

The medium: Learner, information teacher and knowledge. Why are these together?

Abigail: Because the teacher teaches you the information you need, like using the computer and stuff.

Kate: And learning more about what we were learning about too, like when you helped me with my research.

Carrie: But mostly you helped me with the computer, especially at the start, but then not very much for HyperCard.

The medium: Actually, apart from the short little large group session when we first started HyperCard, I don't think I helped you at all, did I?

Carrie: Remember I asked what you thought about my picture?

The medium: Of course, how could I forget? Not! And what about this one, mouse, text, animation, sound, computer?

Amy: Those are all the things in the programs that we used. They sort of belong in all of them, except maybe sound, but the rest we used in all of the programs.

The medium: Now, you've got these 5 things separated. Do you mean these to be separate and apart?

Carrie: They were all part of the cow, but we didn't draw the cow big enough to fit them all in, so we drew them outside, but they all belong in the cow.

The medium: Why a cow?

Kate: Because they have 5 stomachs.

The medium: Are you sure about that?

Carrie: Yeah, I remember reading it somewhere, but I didn't think of the cow first, we figured out the groups and then I thought of the cow.

The medium: So the groups came before the cow, so it didn't necessarily have to be a cow.

Stephanie: No, it could have been something else, like a flower with four petals maybe and a middle.

Kate: I thought of five pieces in a puzzle, but we stayed with the cow because we drew a really good one!

The medium: Oh yes, a perfect cow I must say, perfecto mundo! Okay, alright, but you guys found five groups from all of these words, and then decided on the cow because it had five stomachs and so each stomach represented one group.

All: Right.

The medium: Now could any of these words be shared, or are these lines separating the stomachs, are they solid lines or more like broken lines that let things in and out easily.

Kate: Broken lines, because some of these words belong here, like computer.

Carrie: Actually, maybe the cow is the computer, like it's the thing that is all of these things put together, and they make up the computer, or the cow.

Kate: That's cool, I see that, yeah, I like that, the computer is the cow.

The medium: What about reflection?

Stephanie: We're always reflecting on what we've done on the computer. Reflection was always a part of everything I did, like planning and doing and stuff, everything.

Carrie: But also the computer reflects me, and what I know, you know, sort of like a mirror it reflects back something, well sometimes the computer reflects me, Carrie. I know that this is different than thinking back but that's what I thought reflection meant, you know like a reflection.

The medium: That's interesting. How did the computer, a machine, how was it able to reflect you, the person?

Carrie: Well, like in HyperCard I put in stuff that was special to me, and even somethings that, that maybe only I would know or even like. I think that you could tell that stack was mine if you knew me, you could say, even if you didn't know who did it, that, that was mine, because it's a lot like me.

Abigail: I was always thinking back and it helped me not make so many mistakes, the process was easier every time because we took time to use what we had already learned, even if you had forgotten it, then we would think back and I would remember it again and then it would stick better and I wouldn't make the same mistake twice.

The medium: Has it helped moving ahead?

Stephanie: Uh huh. I used drawing in PowerPoint, you know, like the graphics and stuff, I drew all my pictures in MacPaint, and then when we got to HyperCard, I used some of my stuff from PowerPoint, but it was different, but it still was good.

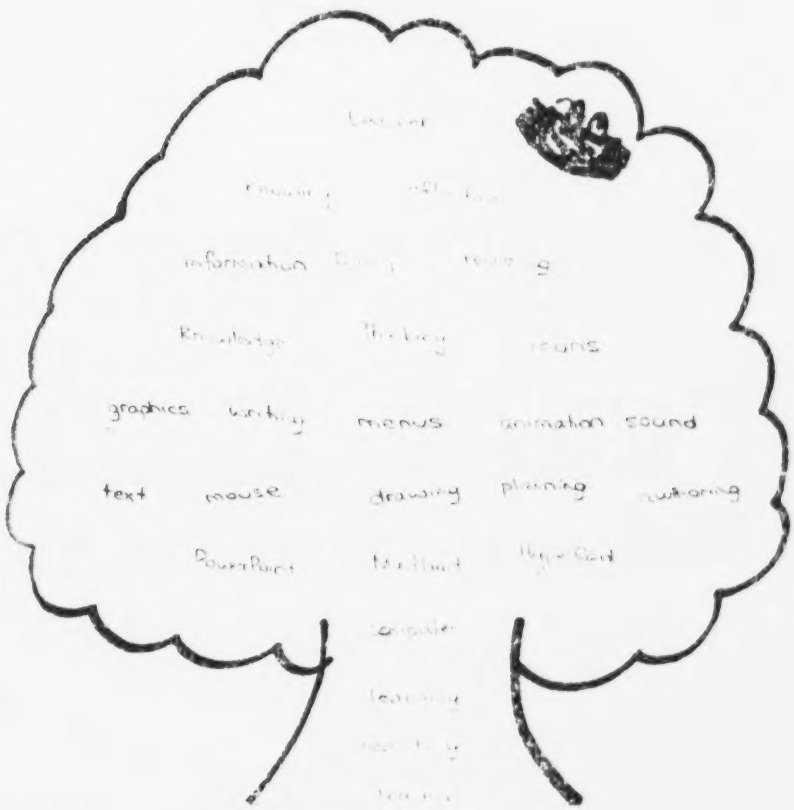
The medium: if you could re-draw this, would you say that just having the outline of the cow, and then having all of the stomachs inside would be a better way to show how you feel about this?

Abigail: We were going to put them all in the cow but the cow was too small, so we put them outside, but we wanted them inside.

Kate: But these are in the main stomach (reflection, thinking, etc.), they were the most important, because they were the things we did the most, we used these all the time.

The medium: But these things don't just apply to computers, these things are things that you would do if you were writing with pencil and paper, or drawing, or using clay, or whatever.

Carrie: They apply to everything. It's bigger for a reason, because you use these whenever you learn something new, anything, not just computers.



Our year using the computers was like a .....Tree.....

Clay: The bottom in the trunk is like where the teacher is, and you taught us how to use the computer.

The medium: And teacher leads to teaching.

Clay: Which leads to learning, like those "ing" words are the things that teachers and learners do.

John: At the bottom of the tree are all the things that we did using the computers, and they connect to everything else that's above them, like they support the tree sort of.

The medium: Okay, so these are the three application programs, and the next row are the things that you did using these programs. Now, in what are these ones, text up to authoring, in what way are these connected?

Jared: Well in HyperCard, you plan and author, in MacPaint you draw, and in PowerPoint you mostly use text, so these ones are right above the programs to show that, that is mostly what you do in them.

Clay: So in HyperCard you look up and you do planning, animation, icons.

John: But you also go out, to sound and authoring. In MacPaint you go up to drawing, and in PowerPoint you go out to mouse and text.

Clay: And some of the things in the middle are connected to all of them, like HyperCard and drawing PowerPoint and drawing, and they all have menus.

The medium: So you just didn't assemble this horizontally, like rows going across, you also organized it vertically, up and down. Interesting. Now, what about this row here, graphics, writing, menus, animation and sound?

Jared: Well animation and sound, they're connected to HyperCard, and then writing is connected to the text and graphics is connected to the mouse,

John: And menus is supposed to go with all of them, either to the side, or above, and even down below, because when you pull down a menu you have different ways of drawing, like text styles and stuff, and different ways of drawing, because menus is the way of doing things.

The medium: Now what about icons?

Jared: Icons are still a part of HyperCard, but they're everywhere sort of, because all we used was icons, and now in HyperCard we're making our own icons, like the buttons I made do the same thing, like, they make stuff happen.

John: Yeah, like all of my buttons now are pictures with transparent buttons because then you can't really tell if my buttons are different than the computers, it's like they're inside the machine already but they're not because I made them, but it's really cool to be able to do the same things as the computer, like, in the same way.

The medium: And information and knowledge?

Clay: Well knowledge and information are related, we're going up now, above knowledge is information, and thinking and doing, like we were always thinking about our stuff and then doing it, and while we were doing it we were thinking some more and sometimes that changed what we were doing.

Jared: Reflection is at the top because that's what you do all the time, like you always think back, and like when I was writing in my journals, or even working, I would be thinking about what I had already done, and sometimes I would stop and go back and do something else real quick so I wouldn't forget and then go back and keep working on my new stuff.

John: All of the things between the learner and the teacher are all the things that we've done, they join us together, it's sort of like these things connected the teacher to the learner, but what we did made the learner grow lots so we put it at the top of the tree 'cos that's the highest point, and we wanted to show that all of the these things made the tree grow but the learner got the most benefit so that's why it's at the top.

Clay: Yeah, like the top of the tree gets the most sunshine.

The medium: Now at the bottom of the tree is the root system, so what are you saying about the role or importance of the teacher?

John: Well you started us off, but then we started growing up and out, and as we did all these things then the tree got bigger and other things helped, but you started us off, and you were like the main support, like when we needed something you always could help us.

Clay: And without the trunk the tree can't grow really tall because it won't be strong, so the teacher helped us build a strong trunk, like, and then the tree could grow really big, or wide, like grow out to the sides too. Like without the teacher, at this point in the year we would still probably be tinkering with just MacPaint, but we're into HyperCard and sound and stuff, really cool stuff.

The medium: Why a tree?

John: Because trees grow, and it was like a growing experience of us learning, and with the tree, no matter what, everything is connected together, like the trunk to the very top branch, and all the branches grow out of the main trunk, and then the tree is a living thing.

Jared: Yeah, like in science how a tree lives in harmony and balance with it's environment, like it takes in stuff and gives off stuff, and it sort of reflects what's happening around it, like if there's pollution and stuff then you see it in the rings of the tree, remember?

The medium: Interesting that you mention the environment, because this tree I suppose wouldn't stand alone, it would be a part of something, so if this is a computer tree, say, describe the surrounding environment.

Jared: I think each tree stands for a learner, so this tree would be in a forest of learner trees, like this tree is me, but it would be beside Jared and Clay's, but they wouldn't have to be the same because they would all grow different because even though we used the same things we know somethings different.

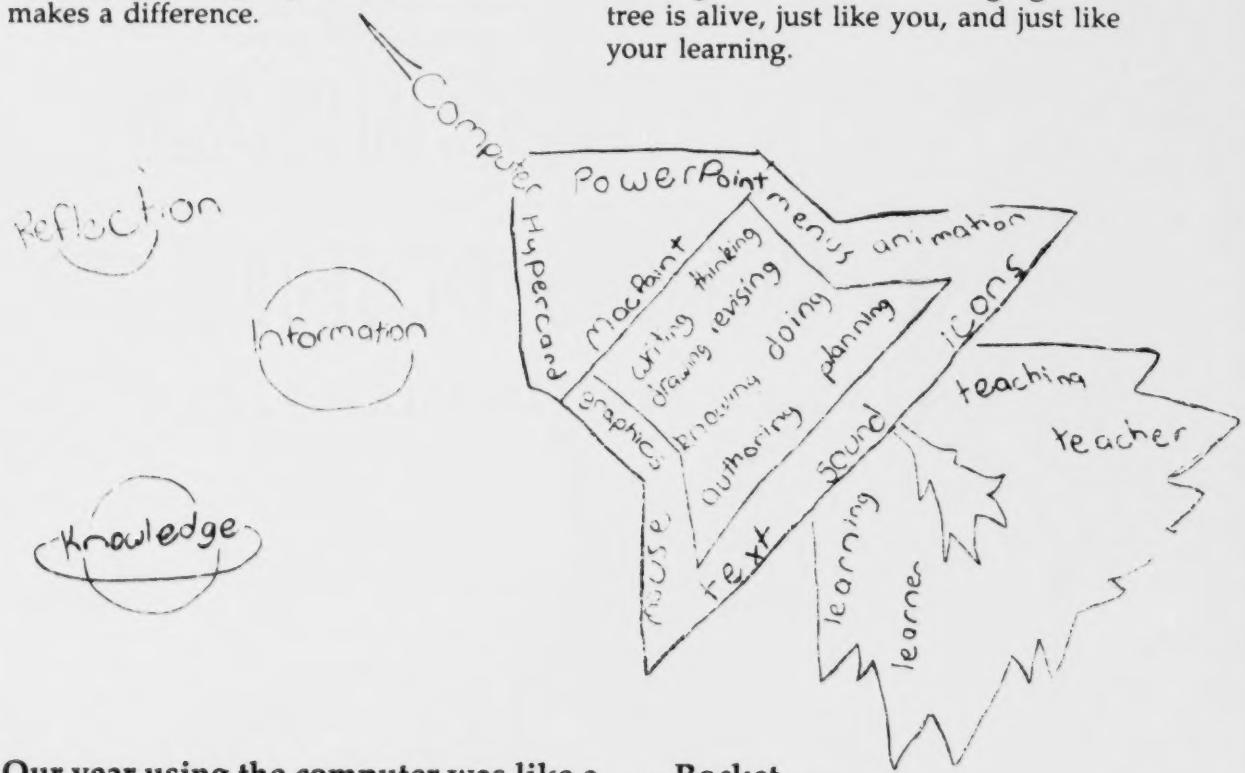
Clay: Some trees might be very wide, and some very narrow, and some might be real bumpy because they know stuff really good on the outside.

John: My tree would be really thick on the HyperCard side, because I love HyperCard and it's really cool so I think I know that the best and I like working in it the best. And now I'm into animation so that part of the tree is really growing right now, so that makes a difference.

Jared: It would have been better to make a model of the tree, then you could see that some things stick out, but we just wanted to show that all of these things are connected.

John: And also, like you could see the tree trunk get bigger like the rings would be growing, and so maybe each time we used the computer we would add another ring now because we know all this stuff, but every time we use the computer we get better and everything improves, so we would maybe add another ring to the tree.

The medium: I love the idea of the growth rings, and the bumpy branches idea, because that's showing change and getting better and developing, but you're saying that it should be moving, all the time changing. The tree is alive, just like you, and just like your learning.



Our year using the computer was like a .....Rocket.....

The medium: Why a rocket, what is special about a rocket, or makes you think of HyperCard?

Michael: Because a rocket goes to new places, and we went to different places in the computer, we explored new places.

Derek: Discovered them too.

The medium: Okay, where did the idea come from?

Michael: Shaun said plane, and then from there we thought of rocket.

Shaun-Dean: We liked the idea of flying to different places, but a plane only flies around the world and we wanted to show that you could go to whole new worlds. There was more unknown, more mystery.

Michael: The learner, learning, teacher and teaching, like, they were the power of the rocket.

Shaun-Dean: The thrust, and the rocket is the computer.

The medium: What I find interesting is that we're, meaning the teacher and learner, are all together, you've grouped them together, why?

Michael: Well you can't teach without a learner, and you can't learn without a teacher, so you need both there for anything to happen, right?

Derek: Yeah, like even when we were learning ourselves we were still teaching ourselves, and then sometimes others would teach us something or we would teach them something, so we were all teachers and learners.

Shaun-Dean: HyperCard and PowerPoint are near the top because they're the main programs, the graphics belong to HyperCard and to PowerPoint. The menus were everywhere.

Michael: And so was animation, I used it in both and it worked really good.

Derek: These are the things that made up the computer, all the different bits and pieces and programs and stuff, and maybe if they are different, maybe if the programs are different, then the rocket has a different shape, but we put these in this shape.

The medium: Now you've got HyperCard, PowerPoint and MacPaint representing the top or the cone of the computer, what was the reason?

Derek: Yeah, they were the second most important thing we got out of the computer, it was sort of like, okay, now that we've got the computer, what do we do with it, and this is it, we did these three.

Michael: These programs sort of guided the rocket too, like the thrust came from the learner and learning and teacher and teaching, but the direction them rocket took was because of these programs, so they guided us to these planets out here.

Derek: Yeah, and so we wouldn't have gone there if we hadn't have learned these programs.

The medium: Interesting, now what about the central grouping here: writing, thinking, drawing, revising, knowing, doing, authoring and planning?

Michael: These were the skills at first, but on the rocket they were the fuel, that's where the rocket got it's power.

Derek: Yeah, they could be, but when we were deciding what to do I thought that they were the cargo, you know how the space shuttle carries stuff in the middle under the doors, well, I thought that these were the cargo instead, but I never said anything because I also agree with the rocket fuel idea too.

The medium: That's interesting that even within the group you could have different meanings for the same thing, and different reasons for putting things in the same place, that's interesting.

Shaun-Dean: Yeah, but that's okay, we can have different reasons and that's okay, it doesn't mean one's wrong or right, they're both okay.

The medium: Yes, you're right, no doubt, that's perfectly okay, it's like we can never completely agree on the meaning of words, like say for instance, London. My meaning of that word is completely different from yours, and even if there was somebody here who had lived in London, even they wouldn't have he same meaning because they're not me. Meaning is personal, gentlemen.

Michael: Okay Mr. K, if you say so!

Derek: For me, these things were stuff you would take to the planets to improve them, to make them better, and when you get to these planets, this thing opens up and these are tools that you can use to make your new world.

Michael: That's cool, yeah, they could improve the knowledge planet and the information planet and the reflection planet, they could maybe be satellites or something that make things better on them.

The medium: I'm curious about the three planets. Tell me more.

Shaun-Dean: These were things we've been learning about all year, like these were the worlds that we went to.

Michael: Because reflection we keep looking back all the time on our projects, and how we did them, to make our new ones better, and when we did that we got more knowledge and information, and so these were the main things we did on the computer all year, the things we used the computer for, sort of like shuttling these things back and forth between these planets. The shuttle sort of went back and forth between them.

The medium: So what's the difference between information and knowledge?

Shaun-Dean: I think information is stuff that you get from reading books and stuff, but knowledge is stuff that you get when you do something.

Michael: To me, information is little bits of stuff that is just there, but then when you put all that stuff together to do a report or a story, then it turns into

knowledge, otherwise it's just there and you read it and stuff but you don't do anything with it, and I think you have to do something with the information before it turns into knowledge.

Derek: Yeah, I like the idea of doing stuff with information, but it has to be something that I'm doing, I think knowledge belongs to the person doing something with the information, you know what I mean, like your knowledge is different from mine because you put it together in your way, and I put it together in mine, my way.

Shaun-Dean: Yeah, that's what I meant, doing something like writing or drawing or something, not just sitting there and reading it.

The medium: Reflection, you've pulled that out and made that a planet, are you saying that it is equally as important as information and knowledge?

Michael: Yeah, we really did a lot of that this year, looking back and thinking about what we had done, fixing up our mistakes and stuff, and then trying to use that in the next thing we did, I did that a lot.

Derek: Other years we never really went back to it, we did something and then just left it and kept going, nothing was tied into anything, so we would do them and leave them.

The medium: Has reflection been valuable?

Shaun-Dean: Oh yeah, like after we finished something we would get time to put down what we learned and stuff, and then I would think a lot about what I did, and if I ever got the chance to do it again what I might do differently, and then after we did PowerPoint I didn't just think about that I thought about that and MacPaint and how they were the same and different, and then when we got to HyperCard it was no big deal because of all the things we brought with us, the things we knew.

Derek: Yeah, there was lots of carry-over from one program to the next, and that really helped, like I think it was a good idea to do graphics first and then PowerPoint and then HyperCard because they sort of built on one another, like they were kind of the same but every time we learned a new package we already knew a lot about it and then there was just more things you could do.

The medium: Thank you guys, I really enjoyed this discussion, and I respect very much how you have taken such care and time to think carefully not only about what you wanted to say, but also how you wanted to say it. Thank you.

Our year using the computers was like a Happy Face because working on the computer was a whole lot of fun and it made us smi
By:
Curtis.D
Curtis.H

Our year using the computer was like a .....Happy Face.....

Jason: I was just thinking about our computer year and how fun it was, and I just said happy face and these guys were okay with that, so we did it.

Curtis: Well, it started out as a happy face, but then we thought of doing a head, you know like with a brain and eyes and ears and stuff, but none of us could draw a good head so we went with the happy face, but it could also be a head of a person.

Jason: Yeah it's sort of like a happy face head, and so that's why it has a nose, the head has a nose because that's one of the most important features of the face because it's an important sense, and the eyes...

Ryan: The smile is for, these programs are the ones that we did that were really fun, like PowerPoint, HyperCard and stuff they were really cool so we put them as the smile.

The medium: Teacher and learner as eyes, that's interesting.

Jason: Well we wanted to show that the teacher and the learner were both eyes, you know how the eyes take everything in and they help us see the world out there and stuff, well, we wanted to show that the teachers and the learners were our eyes.

Ryan: Don't get upset or nothing Mr. Kemp, but like there were times when you didn't teach us anything, like, we learned it ourselves or other guys helped us, so we were all teachers and learners.

The medium: What me, upset, get real, I'm not upset (he says, banging his hand in frustration on the table!). No of course I'm not upset, just don't expect any of my cheque at the end of the month though! (Laughing) No, you're right, absolutely right, I agree 100%, yes, and I also like to think that this happy face is for all the students in the class, and for me too, because I was a learner and a teacher too, this is my happy face too, so no, I agree with what you're saying.

Curtis: Yeah, and like they would help us to see stuff, like if we were having trouble and stuff they'd come and help us out, or maybe they'd just be there watching and say stuff like, "Hey, look at that", and there would be a mistake and they would be helping you.

The medium; Interesting, what about the outside now, the circle, are these in any particular order?

Jason: Well sort of, it starts here with information and then you experience it so you go to knowledge...

The medium: Excuse me, what did you say about experience it and go to knowledge?

Jason: Yeah well like you have to experience information or it just stays as information, like you've got to use it or something, I don't know.

The medium: No, keep going, I'm listening, I think I understand.

Jason: Well if you don't do anything, like if you just sit there and look at something, then it's not knowing something, I think you've got to be there to know something or someplace.

Curtis: I think information comes from the outside of you but knowledge comes from the inside.

The medium: What do you mean?

Curtis: Information comes into your brain, like you know, through the senses and stuff, your eyes, and then goes inside. But when you know something it just comes out, and sometimes you didn't even think about it and even know how you knew that, like it happened to me yesterday, like, I didn't know I knew that stuff and it was just there.

The medium: Interesting! But what about the circle, is there an order?

Jason: Well there's an order, but because it's a circle you get back to where you started, you keep going round and round, so you start off with information and end up with doing it on the computer, but then you keep going.

The medium: Are you at the same place, or has something changed?

Ryan: I think every time you go around it changes, just like Norbert's clock, I was listening to him try to explain it, remember, when the hands would go around and it would be the same time but different, it's the same thing here. It's sort of like an apple peel, you know how it gets longer and curls, like you keep going around but it's different.

The medium: Would it be better if I had given you a choice of how to show your ideas?

Jason: Yeah, I think a sculpture would have been better because then you could show things differently, like the going around.

Ryan: Or an apple!

The medium: Or an apple!

Summary

Recent advances in technology, coupled with a re-viewing of the nature of the educational process and the role that technology might play, are affording educators and learners new, exciting opportunities for exploration, discovery and articulation. While the literature of 5 years ago spoke of the next generation of computers as being "Artificially Intelligent", the difficulties in trying to simulate or replicate the human system, coupled with the advent of computer-based, multi-media authoring environments now promises to re-present the computer as an important, integral aspect in the total context of a new, emerging, educational paradigm. The medium is changing. Education is a dynamic, evolutionary, emergent process, and that process now includes interactive multimedia.

Interactive multimedia means authoring using graphics, sound, animation and digitized graphics. It means writing in a systemic, holistic, interactive fashion in which the author must explicitly account for the interactive nature of the reading/writing process. It means accounting for a multitude of dimensions, media, and disciplines. The messages from the medium of interactive multimedia include stories, reports, databases, poetry and games.

The meaning of the messages from the medium is the personal construction of meaning from the point of viewing of the author and reader. The meanings of this process for the Grade 8 students at Bishop Pocock School in Saskatoon were many and varied, and were presented in a dialogue form, a narrative of experience, a journal of the process.

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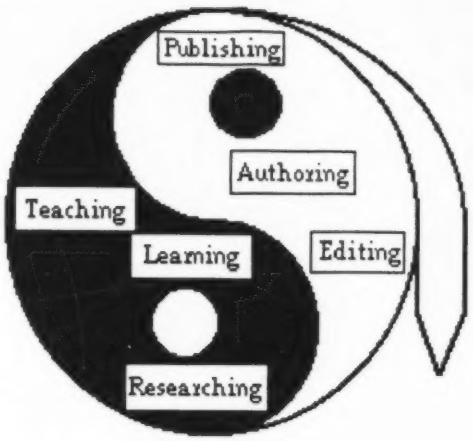
Understanding the nature of the research process

Abstract: This article describes the elements, processes and relationships in the process of research. A paradigm of the nature of the research process will be developed, incorporating the point of viewing of a Taoist cosmology with naturalistic inquiry.



How can we know the dancer from the dance? (Mitchell, 1988, p. viii; Zukav, 1979, p. 197; Weaver, 1985, p. 313) At first glance, the references cited appear to represent a dichotomy of intent. The first reference from Mitchell (1988), employs the metaphor to describe a cosmology, a world-view, The Tao.

> Express yourself completely,
> then keep quiet.
> Be like the forces of nature:
> when it blows, there is only wind;
> when it rains, there is only rain;
> when the clouds pass, the sun shines through.
>
> If you open yourself to the Tao,
> you are at one with the Tao
> and you can embody it completely.
> If you open yourself to insight,
> you are at one with insight
> and you can use it completely.
> If you open yourself to loss,
> you are at one with loss
> and you can accept it completely.
>
> Open yourself to the Tao,
> then trust your natural responses;
> and everything will fall into place. (Chapter 23, Mitchell)

The second and third references employ the metaphor of the dance to allude to a philosophy of Knowing, emerging paradigms in the sciences (Zukav, 1979) and in education (Weaver, 1985). Zukav (1979), in describing the essential nature of matter as "fundamental dancing energy" (p. 212), was seeking a metaphor to describe the nature of the universe as process.

> At the subatomic level, there is no longer a clear distinction between what is and what happens, between the actor and the action. At the subatomic level, the dancer and the dance are one. (Zukav, 1979, p. 197)

The philosophical implication of quantum mechanics is that all of the things in our universe (including us) that appear to exist independently are actually parts of one all-encompassing organic pattern, and that no parts of that pattern are ever really separate from it, or from each other (Zukav, 1979, p. 72).

Weaver (1985), in describing new paradigms in language processing, used the metaphor of dance to describe the transactions between the elements in languaging, meaning evolving from the medium which generated the messages.

> Just as the universe may be viewed as fundamentally a dance of transient forms that sparkle in and out of existence, so meaning, the poem, may be viewed as an ever-fluctuating dance that occurs more or less simultaneously on and across various levels: letters, words, sentences, schemata; writer, text, and reader; text/reader and context; the present reader with other readers, past and present; and so forth; all connected in a multi-dimensional holarchy, an interlocking network or web of meaning, a synchronous dance in which there is no clear distinction between what is and what happens. (Weaver, 1985, p. 313)

Thus the metaphor of "the dance", and our inability to know the dancer from the dance, to view the nature of relationships in philosophy, science and education as being dialectic in nature rather than dichotomous, emerges as a metaphor to describe the complementarity of researcher and researching. This paper proposes to extend the metaphor of dance to the domain of research; a dance between the researcher and the research question, the researcher and the teacher, the researcher and the students.

The Tao as research: Teacher/Learner/Researcher

The Tao, literally translated, means "The Way". In espousing the attributes of simplicity, harmony, respect, reflection, sensitivity and calm, the Tao is a philosophy of Being that seeks a resonance with life. The Tao is not a product but a process, it is not an element but an attitude, it is not an object but rather an attribute.

> As a thing the way is
> Shadowy, indistinct.
> Indistinct and shadowy,
> Yet within it is an image;
> Shadowy and indistinct,
> Yet within it is a substance
> Dim and dark,
> Yet within it is an essence.
> This essence is quite genuine
> And within it is something that can be tested. (Chapter 49, Lau)

The essence of the Tao is harmony, a resonance between Voices, a harmony of Being through listening to Self and to the natural order.

> The Tao gives birth to all beings,
> nourishes them, maintains them,
> cares for them, comforts them, protects them,
> takes them back to itself,
> creating without possessing,
> acting without expecting,
> guiding without interfering.

> That is why love of the Tao
> is in the very nature of things.
> (Chapter 51, Mitchell)

Hoff (1983) alluded to the listening attribute of Taoism when he noted that "the masters of life know the Way, for they listen to the voice within them, the voice of wisdom and simplicity, the voice that reasons beyond Cleverness and knows beyond Knowledge" (p. 154). In listening and reflecting, being sensitive to ourselves and the world around us, in striving for harmony, we follow the Way.

> There is nothing inflexible in him, and so things show themselves up clearly. In his movement he is like water; in his stillness he is like a mirror; in his response he is like an echo. Indistinct, he seems shadowy; silent, he seems limpid...He never leads but always follows behind others. (Lau, 1963, p. 48)

Reflection is the quiet, intra-actional process "by which the person thinks about or examines what he feels, knows, and experiences in order to increase what he knows and understands about himself and his relationship to the world" (Berman & Roderick, 1977, p. 179). Maturana and Varela (1987), contend that "reflection is the only chance we have to discover our blindness and to recognize that the certainties and knowledge of others are, respectively, as overwhelming and tenuous as our own" (p. 24). Reflection, however, has both explicit and implicit aspects: explicitly, as a contemplation of events wherein "one writes the contents of one's life both in a forward and backward way; we work within the present and look at the past in order to better understand the future" (Craig, 1983, p. 374); or, implicitly, as a reflection of who we are, have been, and might become.

> Now, in looking back over the long trail of development, any individual is bound to be struck by the patent fact that life is of a piece. His or her research career is unmistakably a reflection of the person that he or she has been. Of all the possibilities, one raises only certain questions, pursues only certain approaches, and reads the results in only certain ways. What is not selected, followed, and seen, as well as what happens to be chosen, abundantly reveals the boundaries and configurations of the individual's world. (Brimfield, Roderick, & Yamamoto, 1983, p. 15)

This reflection is implicit in the sense that it is a reflection of our experience, our history, our Being, and explicit in the sense of "the on-goingness of experience" (Brimfield, Roderick, & Yamamoto, p. 11) expressed as a narrative, "a way of characterizing the phenomena of human experience" (Connelly & Clandinin, 1990, p. 2). The payoff for reflection is not revision, but insight, for it leads us to uncover layers of meaning around the bits of life we collect (Calkins, 1991, p. 63).

> *The medium*: What about reflection? Did I encourage you to reflect back on what you had done?
>
> Claudia: Whenever we wrote in our journals then we would think back, we would replay

the thing over, and that's reflecting, right?

Chantel: That's in all of them too, because you're always going back to them or thinking about them, like sometimes after I drew a picture I had a new idea, and sometimes more information, and then I would change what I was going to do. Sometimes, like after PowerPoint, when we thought back on what we did, and stuff, I used a lot of that in HyperCard and it really helped, because I'd never kind of kept on using what we had already taken, like most times we would do something and then just leave it and not worry about it anymore, but this year we always kept thinking back and kept using what we already had done to make the new stuff easier..

Abigail: ...and better, like everything I did got better because I kept on using what I already knew, so it made it easier.

The medium: What about you as a learner, is this something different?

Chantel: Yeah, because I improved on my mistakes. But it's the same in other stuff too, like in Math we always keep going back, and the same in social and science, right?

The medium: What about reflection?

Stephanie: We're always reflecting on what we've done on the computer. Reflection was always a part of everything I did, like planning and doing and stuff, everything.

Carrie: But also the computer reflects me, and what I know, you know, sort of like a mirror it reflects back something, well sometimes the computer reflects me, Carrie. I know that this is different than thinking back but that's what I thought reflection meant, you know like a reflection.

The medium: That's interesting. How did the computer, a machine, how was it able to reflect you, the person?

Carrie: Well, like in HyperCard I put in stuff that was special to me, and even somethings that, that maybe only I would know or even like. I think that you could tell that stack was mine if you knew me, you could say, even if you didn't know who did it, that, that was mine, because it's a lot like me.

Abigail: I was always thinking back and it helped me not make so many mistakes, the process was easier every time because we took time to use what we had already learned, even if you had forgotten it, then we would think back and I would remember it again and then it would stick better and I wouldn't make the same mistake twice.

Michael: Because reflection we keep looking back all the time on our projects, and how we did them, to make our new ones better, and when we did that we got more knowledge and information, and so these were the main things we did on the computer all year, the things we used the computer for, sort of like shuttling these things back and forth between these

> planets. The shuttle sort of went back and forth between them.

Thus we have the dancer, but what of the dance? The most characteristic element of Taoism-in-action is known as Wu-Wei (Hoff, 1983, p. 67).

> Literally, Wu-Wei means "without doing, causing, or making." But practically speaking, it means without meddlesome, combative, or egotistical effort. The efficiency of Wu-Wei is like that of water flowing over and around the rocks in its path - not the mechanical, straight-line approach that usually ends up short circuiting natural laws, but one that evolves from an inner sensitivity to the natural rhythm of things. (Hoff, 1983, p. 68)

Caley and Sawada (1990) describe Wei Wu-Wei as a "state of continuing relaxed awareness" (p. 14), in which "the realization of Wei Wu-Wei is simply in the maintenance of recursion" (p. 16).

Return is the movement of the Tao (Chapter 40, Mitchell)

The recursivity, "an endless cycle of development and decline" (Lau, 1963, p. 25) is embedded conceptually in the perspective that Taoism views all natural processes, and explicitly in the text, the Tao Te Ching, which constitutes the medium that is Taoist philosophy, chapters embedded within others or referring back to elaborate and extend a concept. In a context that is recursive, the mind of Wu-Wei "flows like water, reflects like a mirror, and responds like an echo. Using Wu-Wei you go by circumstances and listen to your own intuition. All it really is though, is being sensitive to circumstances" (Hoff, 1983, p. 85).

> If you open yourself to the Tao,
> you are at one with the Tao
> and you can embody it completely.
> If you open yourself to insight,
> you are at one to insight
> and you can use it completely.
> Open yourself to the Tao,
> then trust your natural responses;
> and everything will fall into place. (Chapter 23, Mitchell)

The Tao as research meant for me a tripartite role: teacher, learner and researcher. I was at one and the same time all three, as were the students with whom I was sharing the narrative. Perhaps the most telling comment on the nature of the researcher, and the impossibility of distinguishing the dancer from the dance came from one of my students:

> There are many different people who go into the lab. There are teachers, learners, observers and helpers. This year I have been all of these things, sometimes even in the same period. Even our teacher, Mr. Kemp was all of these things. The teachers are there to teach you about things you don't know. They teach you how to work different options and things you're not sure of. The learners are working on their projects, learning more and more from the teachers, the other learners, observers and helpers. Then there are the

> observers and the helpers who just sort of wander around sometimes helping out and giving advice or just watching people work. (Ryan)
>
> Yeah, like even when we were learning ourselves we were still teaching ourselves, and then sometimes others would teach us something or we would teach them something, so we were all teachers and learners. (Derek)
>
> Don't get upset or nothing Mr. Kemp, but like there were times when you didn't teach us anything, like, we learned it ourselves or other guys helped us, so we were all teachers and learners. (Ryan)
>
> When participants assume roles of learner and teacher, as called for by the situation, the unanticipated is not perceived as a threat but rather as an opportunity for further examination of ideas and self. In addition, once students overcome their initial apprehensions about interacting with an "established" researcher, the ensuing relationship is one where colleagues engage in mutual sharing. In this relationship, students appear to develop a sense of self as initiator and sustainer as well as responder and receiver. For some students, this is a major shift in their concept of self as student. (Brimfield, Roderick, & Yamamoto, 1983, p. 16)
>
> Mr. Kemp just likes to come in and visit. He always helps us when we ask, but lots of times he just comes in and sits and watches and listens, but we keep talking anyway. (John)

John's description raised an interesting point about my role in the process. I had not articulated my perspective and approach as to how I wanted to conduct myself in the variety of roles that I had assumed: researcher, teacher, and learner. Interestingly, however, my quiet, attentive approach to all of these had not gone unnoticed by the students. Many times it was noted by them in their journal entries. John's comment from above was, "lots of times he just comes in and sits and watches and *listens* ", while Tyler's was that "he occasionally asked us questions about what we were doing, but mostly he just sat there and *listened* ". I always tried to make myself available when necessary, for help or advice or comments on any aspect of their projects. But I rarely, if ever, initiated the dialogue, preferring instead to allow the students to begin. There were many, many times when I literally just stood or sat and watched and listened! At first this was disconcerting for me, because I was used to the more traditional paradigm of teacher-initiated, teacher-directed projects where I was in a management mode and controlled and prescribed the entire process. But in the lab, I approached every opportunity with an attitude of collaboration, of patience, of sensitivity, and of just letting things happen. It was an attitude of being open to surprise, and the surprise I got was continual amazement at the depth and scope of learning and exploring that self-motivated, self-referential, self-maintaining learners could create. Not only did this approach create an unprecedented (in my teaching experience) degree of

attachment and engagement to the task, but it allowed the students to grow and assume all of the different aspects in an educational environment.

Research as the Tao: Author/Editor/Publisher

Research as the Tao is the bringing forth of Voice, a poiesis of Self and others, a resonance between the dancers, and between the dancers and the dance such that separately they cannot be known, but in a complementarity of unison they are the essence of the question at hand. Research as the Tao is the construction of meaning, the emerging figure from the ground, the process of researching. That process was for me the authoring, editing and publishing of *The medium*.

Wu-Wei, as Taoism-in-action, is interpreted in the context of this research as *The medium*. The nature of the researching process is, by definition, recursive, an autopoietic organization which is self-generating and self-maintaining, a medium in which there is a complementarity between the dancers, and between the dancers and the dance. I was author, editor and publisher, there was no way of Knowing the dancer from the dance. This bringing forth of a world, this "text about how one is situated with respect to others and toward the world - a canonical text about powers and skills and dispositions that change as one's situation changes from young to old, from one kind of a setting to another" (Bruner, 1986, p. 130), is the articulation of Voice, "the unfolding, stretching into, and disturbance of every aspect of a writer's world" (Calkins, 1991, p. 7).

The medium: So what is the link, then, between your dissertation research, and this journal?

Mr. Kemp: I think the answer is in the title of the journal itself, a sort of self-referential, recursive process. The title of the journal reflects the nature of the research, and the research question. The very use of the term "reflection" is itself important because this was one attribute of the medium that was the context in which my research took place. And there's another term, context, because a medium is a context, a way of doing, a point of viewing, a means, an agency, an environment. So to use the term medium in the title of a medium, and to have been looking at a medium as my research question, to me sums up the very essence of what I was trying to do. My interest lay in the area of authoring and publishing, so to author and publish a journal called *The medium* was a means, a way, of articulating that experience which was resonant with what I was trying to do.

The medium: So *The medium* as a journal, then, is symbolic of the nature of your research and the question which you were investigating?

Mr. Kemp: More than symbolic, I like to think it was iconic, self-referential, able to be experienced. To me, a symbol is inert, a representation, a static means of communication. But an icon represents in itself the essence of that which it is

representing, it is a metaphor, a poem of sorts.

The medium: So the journal is a metaphor?

Mr. Kemp: Yes, but so are all of the aspects of the journal. Take the title for instance. A medium is defined as including one or all of many aspects: It can be a tool, a device; it can be a means or agency of change; it can be an intervening substance through which change can be effected; and it can also be an environment, a context. So to use the title "The medium", was also a metaphor for the nature of my research and the process which I followed in trying to understand that lived experience of understanding the medium of authoring using a computer. My journal is all of the above, it was a tool, a means, a way, an agency, a context. My research was all of the above. My research question looked at the nature of a particular medium.

The medium: So everything in the journal is intertwined, what about your roles as author, editor and publisher?

Mr. Kemp: Yes, here again, everything is intertwined. It wasn't as if at some point I was an author, and then suddenly became an editor or publisher and stopped being the author. I was all of those things continuously. And here again, I was trying to capture the essence of what I feel is the nature of all things, all processes: complementarity.

Sawada and Pothier (1988) describe the Reflection Methodology paradigm of research which "formalizes this type of conversational dyad (researcher/subject) as an autopoietic conversational paradigm, and as such enhances the emergence of new order" (p. 6). Thus from the circularity of recursive processes between the elements in the research question emerges a new order, the essence of which can only be captured by the circularity of recursive processes, the contemplation of what is, has been, and might become. *The medium* is the journal, "the private, self-expressive, and reflective writing one can do as a way of understanding self" (Craig, 1983, p. 373).

> I call it finding a voice of one's own because one is writing in a more holistic way. The total self is expressing rather than polishing for another reader. The journal entry taps the reality of the lived experience and it does find a voice of its own. (Craig, 1983, p. 375)

Fulwiler (1982), described the journal in recursive terms as "a record of evolving insight as well as the tool to gain that insight" (p. 25). The journal is the student's own voice (Fulwiler, 1982, p. 17), embodying the idea that "we put bits of our lives and our thinking into print not only to produce compositions but also because we do not want to walk around unwritten" (Calkins, 1991, p. 37). The researcher as learner, therefore, can tap into the experience of self as expressed by the students, and the experience of Self through reflection and articulation. The journal is the medium for the articulation of voice.

> Voice is meaning that resides in the individual and enables that individual to participate

> in a community. The struggle for voice begins when a person attempts to communicate meaning to someone else. Finding the words, speaking for oneself, and feeling heard by others are all a part of this process. Voice suggests relationships: the individual's relationship to the meaning of her/his experience, and hence, to language, and the individual's relationship to the other, since understanding is a social process. (Connelly & Clandinin, 1990, p. 4)

The Tao as research is a way of Being, a sensitivity to the world both within and without, a still, calm, reflective process of poiesis. Research as the Tao is a way of knowing, a recursive, reciprocal, reflective process of emerging insight, a bringing forth of voice.

> Mr. Kemp: The medium, if you will, for *The medium*, was, and is, my journal. I began keeping a journal shortly after I arrived in Edmonton, and it is full of ideas, doodles, drawings, quotes, anecdotes, plastic wrap of mints following tea, notes and xeroxed pictures. *The medium* evolved out of my journal, and each issue emerged from the one previous. The proposal issue, for example, described aspects of my review of the literature, my question, my research methodology, and so on. That in turn became the ground from which the first issue emerged. For instance, in the Welcome to Macintosh issue, there was a discussion of the nature of the computing medium. This formed the basis for the second issue, Understanding hypermedia, in which we described the nature of one specific medium, HyperCard. In there was a reference to ecology. The term was introduced and described in that second issue, but became the dominant theme or perspective for the third issue. Similarly, this notion of ecology was extended into the fourth, or summary issue to emerge as a discussion of the nature of the authoring process. Finally, the fourth, or summary issue will be entitled "The nature of the authoring process in a computing medium" which is the subtitle of the journal itself, and the title of my proposal document from which all of this has evolved.
>
> *The medium*: And reflexive?
>
> Mr. Kemp: Well, our earlier discussion about how the journal itself, the title, the research question, the research process, everything is self referential. If not for the recursivity, however, the whole thing would become cyclical and there would be no levelling, no growth. Even this article is reflexive, is it not?
>
> *The medium*: Either that, or schizophrenic!! But let's stay focused shall we? Now what about the reciprocity?
>
> Mr. Kemp: Well the reciprocity happened on many different levels. There was the obvious reciprocity of myself being both the author and editor and publisher, I was forever blending or melding the roles and perspectives of one into the other until trying to make a distinction became meaningless. There was the reciprocity between those aspects and my other roles as teacher and learner and researcher. There

was the reciprocity between myself and the grade 8 students and post-secondary students that I had the privilege of sharing this journey. Then there was the reciprocity between the students, and between the students and the technology, between myself and the technology, and so on and so on.

The medium: A stylus of Voice

In proposing an inquiry into the nature of the authoring experience in a computing medium, the task became one of making explicit the Voice that was within me, the students, and our Voice in unison, as a harmony or resonance. It was proposed that the Tao of research in this context was to listen, to become resonant with the medium and the entities that constituted that medium, the processes which facilitated our dialogue, and the relationships between those elements and processes. In specific terms, the medium within which the medium was made explicit, the medium from which the messages emerged, was that of *The medium*, the Voice of "the journeyman keeping the tale of himself, and of the other people who are travelling with him along the way" (Craig, 1983, p. 374).

Understanding the nature of the research process was, therefore, in this context, *The medium*, a stylus of Voice.

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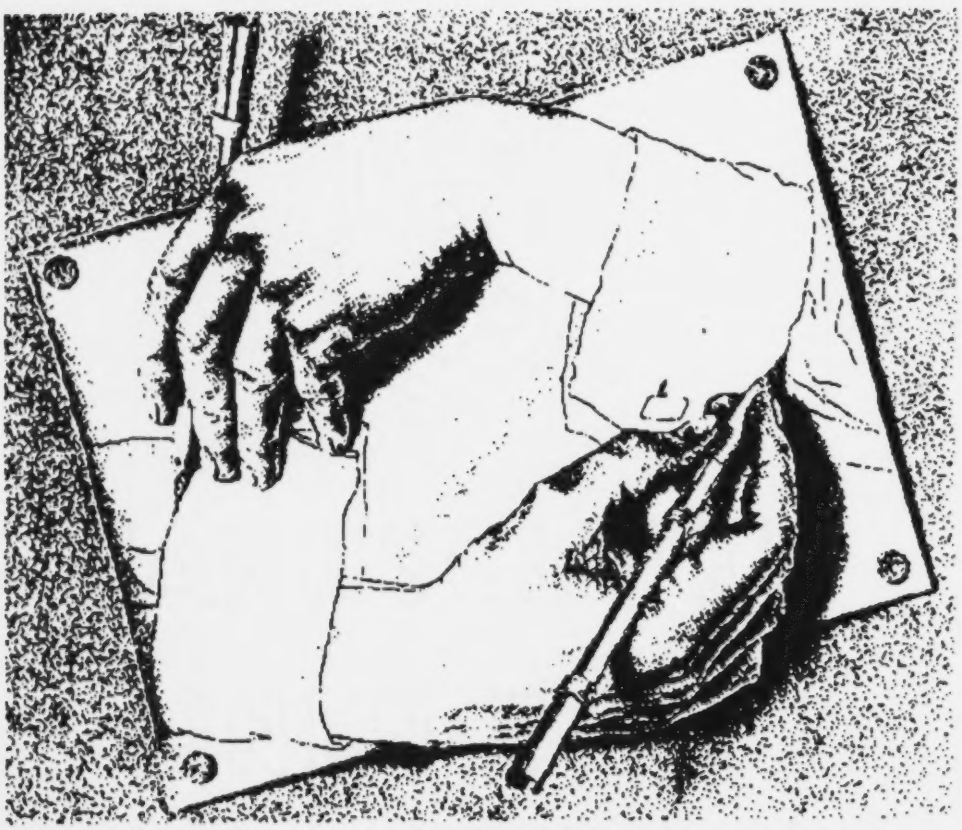
The medium

An inquiry into the nature of the authoring experience in a computing medium



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